Validation Report

Colorado, SPS-2
Task Order 24, CLIN 2
April 29 to 30, 2008

List of Tables

List of Figures

1 Executive Summary

A visit was made to the Colorado 0200 on April 29 to 30, 2008 for the purposes of conducting a validation of the WIM system located on I-76 approximately 1 mile north of the Keenesburg exit. The SPS-2 is located in the righthand, northbound lane of a four-lane divided facility. The posted speed limit at this location is 75 mph. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This site is located 19.5 miles east of the original installation. This is the third validation visit to this location. The site was installed on April 25 to 27, 2006 by IRD.

This site demonstrates the ability to produce research quality loading data under the observed conditions. The classification algorithm is not currently providing research quality classification information.

The site is instrumented with bending plate and iSYNC electronics. It is installed in portland cement concrete.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 75,890 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,180 lbs., the "partial" truck.

The validation speeds ranged from 62 to 74 miles per hour. The pavement temperatures ranged from 47 to 103 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was also achieved.

Table 1-1 Post-Validation results – 080200 – 30-Apr-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-5.0 ± 5.8%	Pass
Tandem axles	±15 percent	-0.1 ± 4.0%	Pass
GVW	±10 percent	-0.9 ± 3.3%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

The pavement condition appeared to be satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area.

Profile data was last collected at this location by Nichols Consulting Engineers on August 30, 2007.

At that time all of the values fall between the index limits indicating that the pavement roughness may or may not interfere with the validation outcome.

There has been no other profile information collected between site installation and the current validation visit.

If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 1-2 Results Based on ASTM E-1318-02 Test Procedures

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

Prepared: djw *Checked: bko*

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on October 16 to 17, 2007. After contacting IRD, it was discovered that the maintenance activities included the replacement of the bending plate signal analysis board (SSM), firmware had been updated and the factors were changed to compensate for an expected drop in weights as a result of the upgrade.

This site needs four years of data to meet the goal of five years of research quality data.

2 Corrective Actions Recommended

No corrective actions are required for this site at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted April 30, 2008 during the morning and afternoon hours at test site 080200 on I-76. This SPS-2 site is at milepost 39.7 on the northbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the calibration and for the subsequent validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 75,890 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,180 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 62 to 74 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 47 to 103 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was also achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

As shown in Table 3-1, this site met all LTPP requirements for research quality loading data.

Table 3-1 Post-Validation Results – 080200 – 30-Apr-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-5.0 ± 5.8%	Pass
Tandem axles	±15 percent	-0.1 ± 4.0%	Pass
GVW	±10 percent	-0.9 ± 3.3%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the morning and afternoon hours under mostly sunny weather conditions, resulting in a range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and three temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided as follows: Low speed – 62 to 66 mph, Medium speed – 67 to 71 mph and High speed – 72 + mph. The three temperature groups were created by splitting the runs between those at 47 to 70 degrees Fahrenheit for Low temperature, 71 to 88 degrees Fahrenheit for Medium temperature and 89 to 103 degrees Fahrenheit for High temperature.

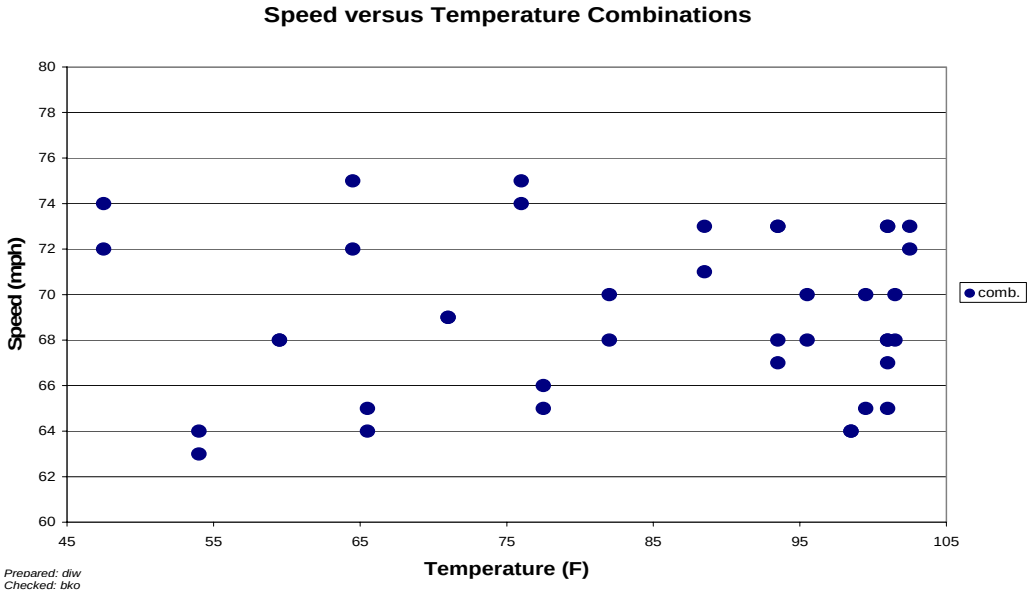

Figure 3-1 Post-Validation Speed-Temperature Distribution – 080200 – 30-Apr-2008

A series of graphs was developed to investigate visually any sign of a relationship between speed or temperature and the scale performance.

Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. It can be seen from the graph that the GVW is generally estimated accurately by the WIM equipment over the entire speed range. The scatter of error is also consistent over the entire speed range.

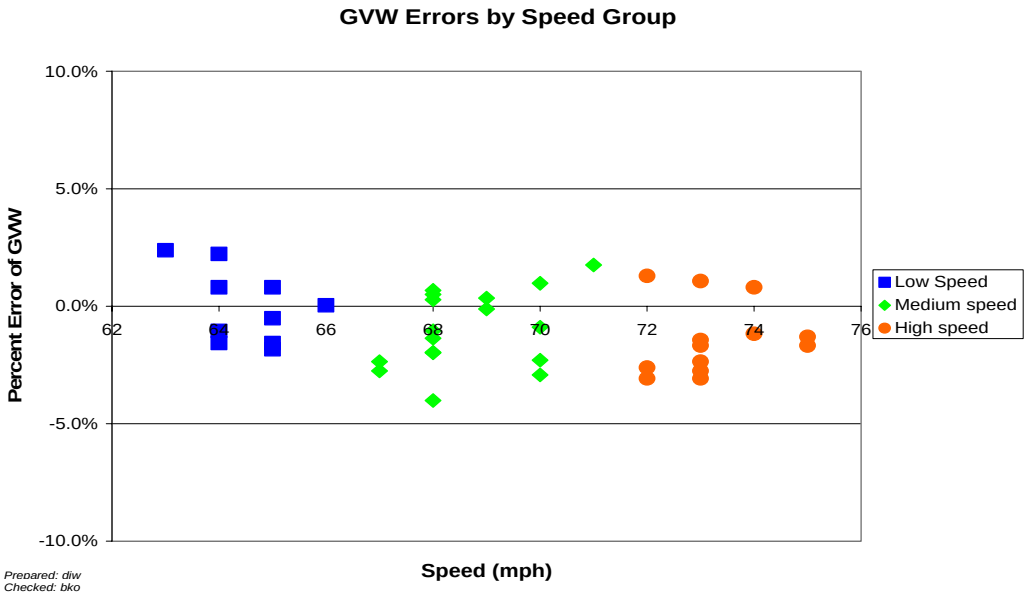

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 080200 – 30-Apr-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. The graph illustrates that the equipment underestimates GVW at the higher temperatures with what would appear to be a slight downward trend. Scatter appears to remain consistent over the entire temperature range.

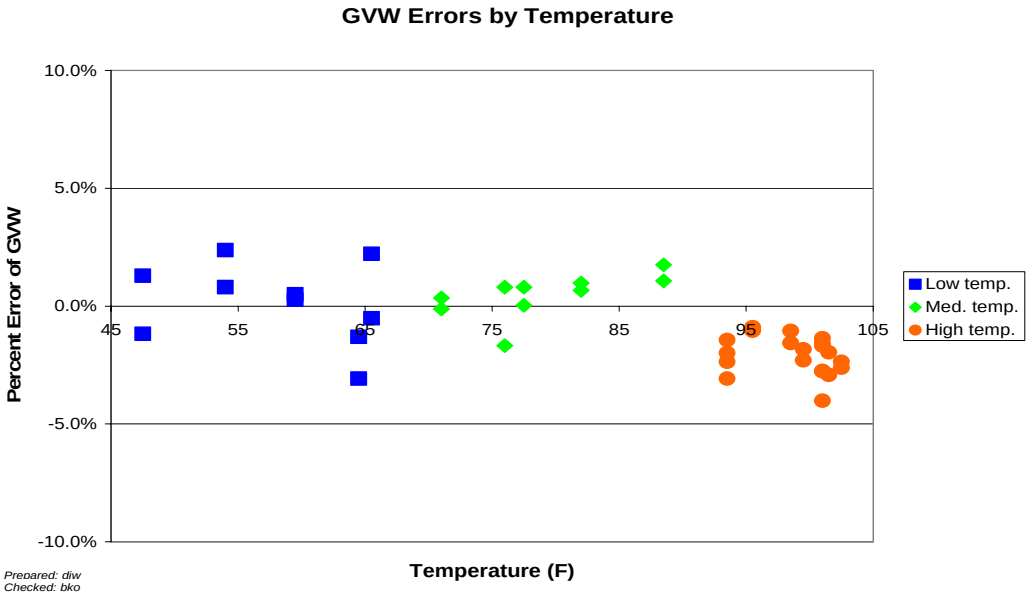

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 080200 – 30-Apr-2008

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. Axle spacing errors appear to be consistent throughout the test truck speed range and are limited to about 1.2 inches (0.1 feet). Vehicle speeds appear to have no effect on the error of measured axle spacing.

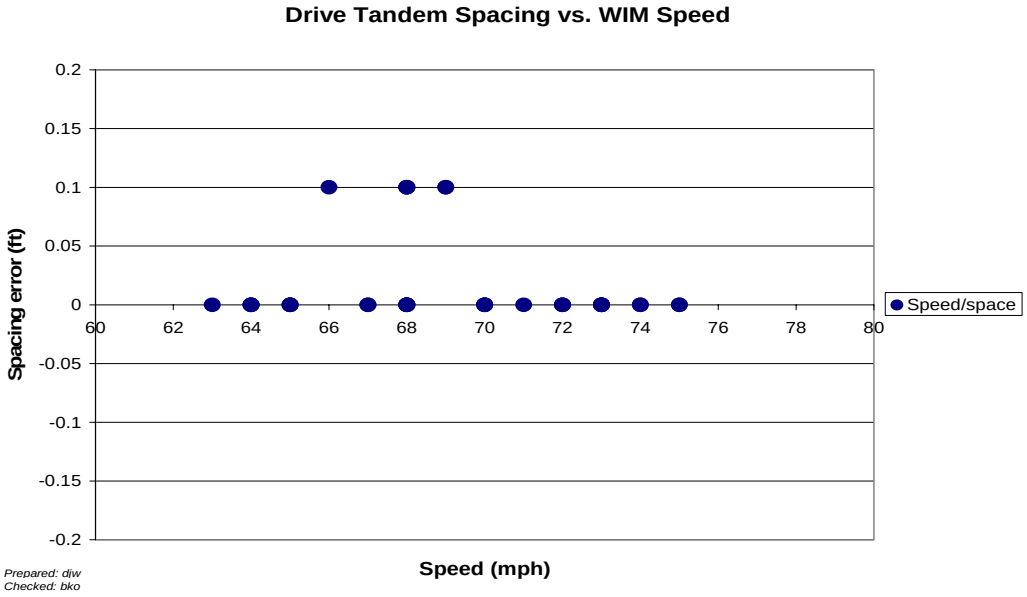

Figure 3-4 Post-Validation Spacing vs. Speed – 080200 – 30-Apr-2008

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 47 to 70 degrees Fahrenheit for Low temperature, 71 to 88 degrees Fahrenheit for Medium temperature and 89 to 103 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 080200 – 30-Apr-2008

Element	95% Limit	Low Temperature 47 to 70 °F	Medium Temperature 71 to 88 °F	High Temperature 89 to 103 °F
Steering axles	±20 %	-2.0 ± 3.8%	-4.2 ± 4.0%	-6.9 ± 4.7%
Tandem axles	±15 %	0.6 ± 4.4%	1.4 ± 3.5%	-1.1 ± 3.1%
GVW	±10 %	0.1 ± 3.8%	0.5 ± 2.1%	-2.1 ± 1.7%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 3-2, it appears that the equipment increasingly underestimates steering axle weights as temperature increases. For tandem weights and GVW, the equipment appears to estimate weights with reasonable accuracy at the low and medium temperatures, and underestimate these weights at the higher temperatures. Scatter in error for all weights appear to remain reasonably consistent throughout the entire temperature range.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. GVW estimation and scatter appear to be reasonably consistent at the low and medium temperatures for the population as a whole. At the higher temperatures, the equipment underestimates GVW for both the Golden Truck (squares) and the partially loaded truck (diamonds).

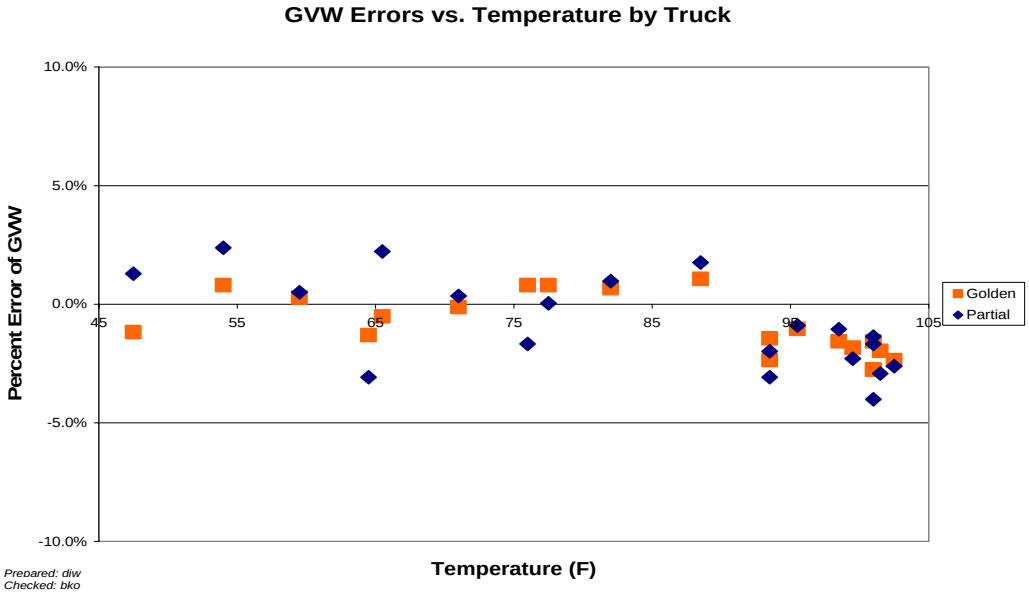

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 080200 – 30-Apr-2008

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure illustrates a tendency for the equipment to increasingly underestimate steering axle weights as the temperature increases.

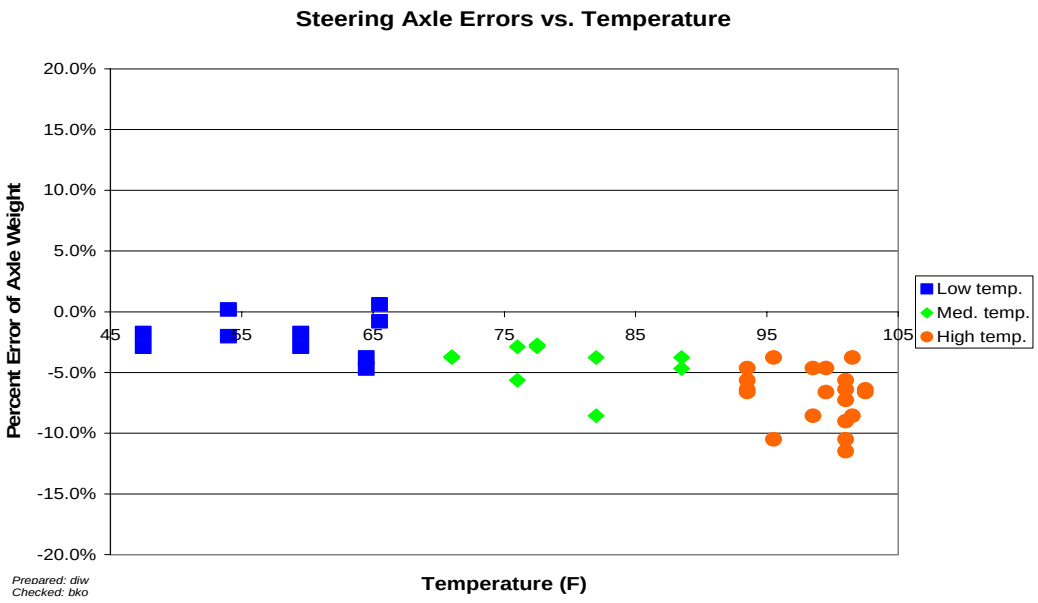

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 080200 – 30-Apr-2008

3.2 Speed-based Analysis

The three speed groups were divided using 62 to 66 mph for Low speed, 67 to 71 mph for Medium speed and 72+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 080200 – 30-Apr-2008

Element	95% Limit	Low Speed 62 to 66 mph	Medium Speed 67 to 71 mph	High Speed 72+ mph
Steering axles	±20 %	-3.3 ± 6.9%	-6.1 ± 6.5%	-4.8 ± 3.5%
Tandem axles	±15 %	0.6 ± 4.0%	0.0 ± 4.2%	-0.7 ± 4.0%
GVW	±10 %	0.0 ± 3.5%	-1.0 ± 3.4%	-1.4 ± 3.3%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 3-3, it appears that the mean error for Tandem axle weights and GVW is estimated with reasonable accuracy throughout the entire speed range. Scatter for these weights are also consistent throughout the entire speed range. Steering axle weights are increasingly underestimated as speed increases and scatter decreases as speed increases.

Figure 3-7 illustrates the ability of the WIM equipment to estimate GVW with reasonable accuracy at all speeds for the truck population as a whole as well as each truck individually. Scatter in error for all trucks is also consistent throughout the entire speed range.

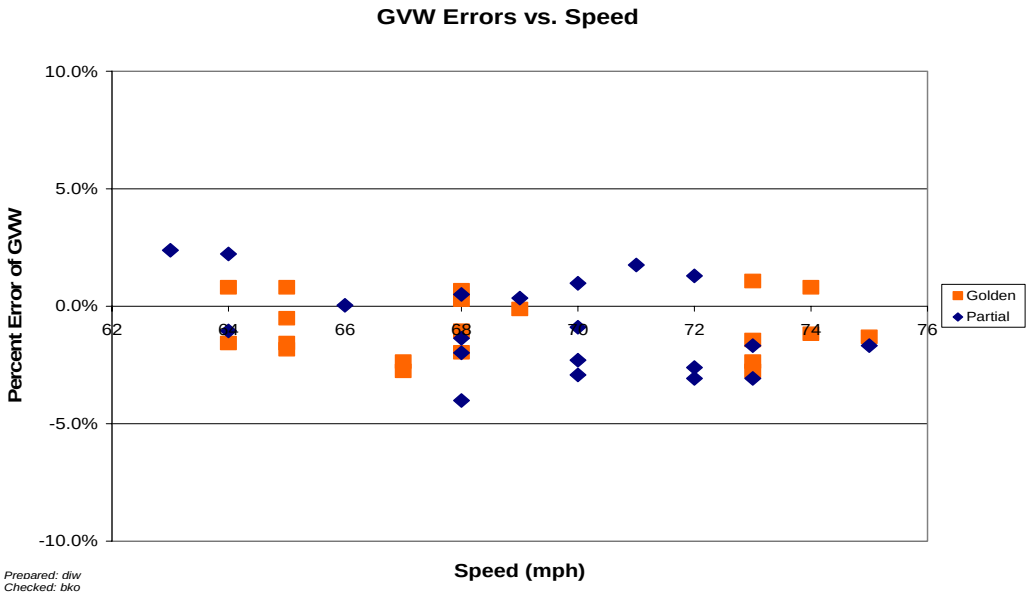

Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 080200 – 30-Apr-2008

Figure 3-8 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Figure 3-8 shows how the WIM equipment underestimates steering axle weights at all speeds.

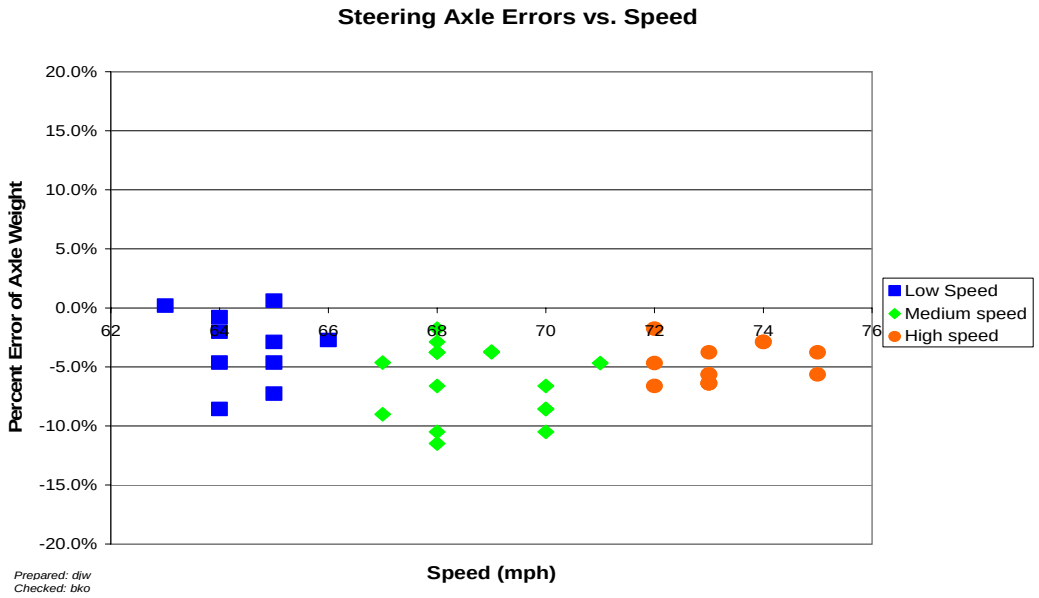

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 080200 – 30-Apr-2008

3.3 Classification Validation

This LTPP installed site uses the FHWA 13-bin classification scheme and the LTPP ETG mod 3 classification algorithm. Classification 15 has been added to define unclassified vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based on the sample it was determined that there are zero percent unknown vehicles and five percent unclassified vehicles. The unclassified vehicles were caused by a problem with the system firmware that needed to be corrected remotely by IRD.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 10.7 percent. The large numbers associated with Classes 7 and 8 reflect the small numbers identified (1 and 3) by the equipment.

Table 3-4 Truck Misclassification Percentages for 080200 – 30-Apr-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	22	6	0
7	100				
8	100	9	4	10	0
11	0	12	0	13	N/A

Prepared: djw *Checked: bko*

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent. The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 3-5 Truck Classification Mean Differences for 080200 – 30-Apr-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	- 22	6	0
7	-100				
8	UNK	9	- 4	10	0
11	0	12	0	13	N/A

Prepared: djw *Checked: bko*

These error rates are normalized to represent how many vehicles of the class are expected to be over or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them or one

hundred out of one hundred. Numbers 1 or larger indicate at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown (UNK) are those identified by the equipment but no vehicles of the type were seen by the observer. No tractor semi-trailer Class 8s, the LTPP visual definition were observed thus this class is labeled UNK in the Post-Validation classification sample. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

A limited investigation of the precision and bias of the speeds reported by the equipment was undertaken. The values were not within the expected tolerances. Since the classification data for heavy trucks did not meet research quality standards with an acceptable level of spacing error, the observed bias and variability for speed are thought to be more strongly related to radar speed precision than errors in the WIM equipment.

3.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 3-6 Results of Validation Using ASTM E-1318-02 Criteria

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

Prepared: djw *Checked: bko*

4 Pavement Discussion

The pavement condition did not appear to influence truck movement across the sensors.

4.1 Profile Analysis

The WIM site is a section of pavement that is 305 meters long with the WIM scale located at 274.5 meters from the beginning of the test section. An ICC profiler was used to collect longitudinal profiles of the test sections with a sampling interval of 25 mm.

Profile data collected at the SPS WIM location by Nichols Consulting Engineers on August 30, 2007 were processed through the LTPP SPS WIM Index Software, version 1.1. This WIM scale is installed on a rigid pavement.

A total of 8 profiler passes were conducted over the WIM Site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM sections, the requirements have been a minimum of 3 passes in the center of the lane and one shifted to each side. For this site, the RSC has completed 4 passes at the center of the lane, 2

passes shifted to the left side of the lane, and 2 passes shifted to the right side of the lane. Shifts to the sides of the lane were collected as close to the lane edges as was safely possible. For each profiler pass, profiles were recorded under the left wheel path (LWP) and the right wheel path (RWP).

The SPS WIM Index software was developed with four different indices: LRI, SRI, Peak LRI, and Peak SRI. The LRI incorporates the pavement profile starting 25.8 m prior to the scale and ending 3.2 m after the scale in the direction of travel. The SRI incorporates a shorter section of pavement profile beginning 2.74 m prior to the WIM scale and ending 0.46 m after the scale. The LRI and SRI are the index values for the actual location of the WIM scale. Peak LRI is the highest value of the LRI, within 30 m prior to the scale. Peak SRI indicates the highest value of SRI that is located between 2.45 m prior to the scale and 1.5 m after the scale. Also, a range for each of the indices was developed to provide the smoothness criteria. The ranges are shown in Table 4-1. When all of the values are below the lower thresholds, it is presumed unlikely that the pavement smoothness will significantly influence sensor output. When one or more values exceed an upper threshold, there is a reasonable expectation that the pavement smoothness will influence the outcome of the validation. When all values are below the upper threshold but not all below the lower threshold, the pavement smoothness may or may not influence the validation outcome.

Table 4-1 Thresholds for WIM Index Values

Index	Lower Threshold (m/km)	Upper Threshold (m/km)
LRI	0.50	2.1
SRI	0.50	2.1
Peak LRI	0.50	2.1
Peak SRI	0.75	2.9

Prepared: djw *Checked: bko*

Table 4-2 shows the computed index values for all 8 profiler passes for this WIM site. The average values over the passes in each path were also calculated when three or more passes were completed. These are shown in the right most column of the table. Values above the upper index limits are presented in bold while values below the lower index limits are presented in italics.

Table 4-2 WIM Index Values – 080200 – 30-Aug-2007

Profiler Passes			**Pass 1**	**Pass 2**	**Pass 3**	**Pass 4**	**Ave.**
Center	LWP	LRI (m/km)	0.948	0.813	0.750	0.711	0.806
		SRI (m/km)	1.339	0.966	1.030	0.959	1.074
		Peak LRI (m/km)	1.008	0.985	0.991	1.066	1.012
		Peak SRI (m/km)	1.397	1.038	1.044	0.987	1.116
	RWP	LRI (m/km)	0.697	0.687	0.708	0.699	0.698
		SRI (m/km)	1.035	0.794	0.901	0.804	0.884
		Peak LRI (m/km)	0.762	0.753	0.843	0.811	0.792
		Peak SRI (m/km)	1.132	0.888	0.951	0.821	0.948
Left Shift	LWP	LRI (m/km)	1.019	0.985			
		SRI (m/km)	1.492	1.196			
		Peak LRI (m/km)	1.131	1.234			
		Peak SRI (m/km)	1.573	1.535			
	RWP	LRI (m/km)	0.708	0.673			
		SRI (m/km)	0.936	1.200			
		Peak LRI (m/km)	0.708	0.702			
		Peak SRI (m/km)	1.004	1.253			
Right Shift	LWP	LRI (m/km)	0.652	0.729			
		SRI (m/km)	0.724	0.844			
		Peak LRI (m/km)	0.827	0.730			
		Peak SRI (m/km)	0.788	0.972			
	RWP	LRI (m/km)	0.811	1.036			
		SRI (m/km)	0.853	1.277			
		Peak LRI (m/km)	1.022	1.336			
		Peak SRI (m/km)	0.878	1.550			

Prepared: djw *Checked: bko*

From the table, it can be seen that all of the values fall between the index limits indicating that the pavement roughness may or may not interfere with the validation outcome.

There has been no other profile information collected between site installation and the current validation visit.

4.2 Distress Survey and Any Applicable Photos

During a visual survey of the pavement, no distresses that would influence truck movement across the WIM scales were noted.

4.3 Vehicle-pavement Interaction Discussion

A visual observation of the trucks as they approach, traverse and leave the sensor area did not indicate any visible motion of the trucks that would affect the performance of the WIM scales. Trucks appear to track down the wheel path and daylight cannot be seen between the tires of any of the sensors for the equipment.

5 Equipment Discussion

The traffic monitoring equipment at this location includes bending plate sensors and iSYNC electronics. The sensors are installed in a portland cement concrete pavement.

The firmware for the weighpad analyzer board (SSM) had been changed since the validation on October 17, 2007.

5.1 Pre-Evaluation Diagnostics

A complete electronic and electrical check of all system components including in-road sensors, electrical power, and telephone service were performed immediately prior to the validation. All sensors and system components were found to be operating within acceptable tolerances.

5.2 Calibration Process

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on October 17, 2007. The site had equipment maintenance work and factor adjustments were made between our last validation visit and this one.

Although not required, one-iteration of the calibration process between the initial 40 runs and the final 40 runs was completed to improve the statistics by reducing the over-estimation at the upper end of the speed range.

5.2.1 Calibration Iteration 1

The operating system weight compensation parameters that were put in place as a result of the Pre-Validation and were in place during the Validation and remained afterward are as follows:

	Left Sensor 1	Right Sensor 2
88 kph	3502	3466
96 kph	3517	3482
104 kph	3480	3447
112 kph	3480	3446
120 kph	3419	3386
		Prepared: djw *Checked: bko*

Table 5-1 Calibration Iteration 1 Results – 080200 – 30-Apr-2008 (07:47 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-3.6 ± 3.6%	Pass
Tandem axles	±15 percent	0.3 ± 4.1%	Pass
GVW	±10 percent	-0.4 ± 3.3%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	Pass
		Prepared: djw	*Checked: bko*

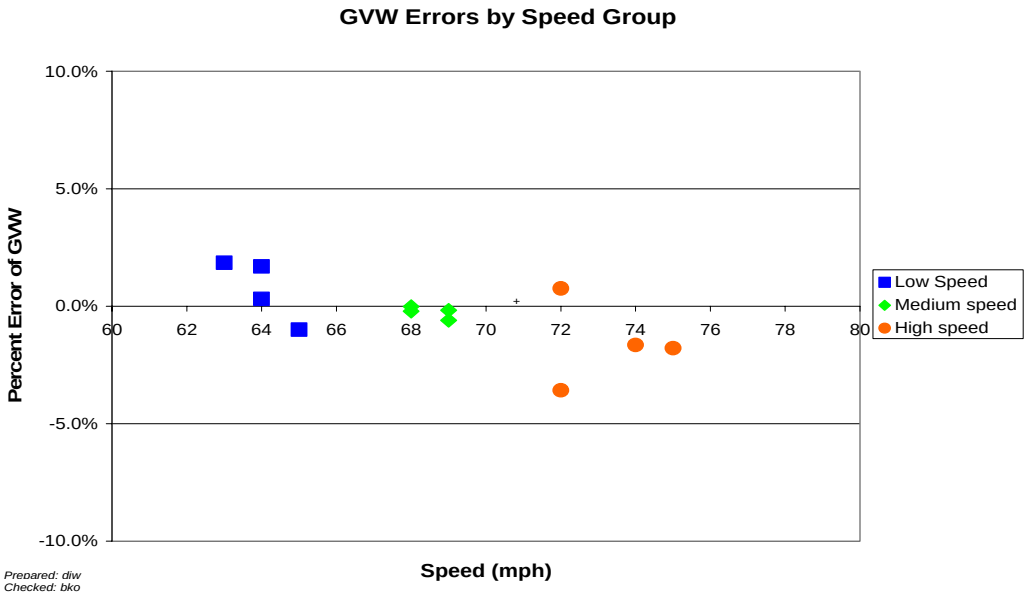

Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 080200 – 30-Apr-2008 (07:47 AM)

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below. Table 5-2 has the information for TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available reflect this contractor's validation visits.

Table 5-2 Classification Validation History – 080200 – 30-Apr-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
04/30/08	Manual	- 4.1	UNK			5%
04/29/08	Manual	0.0	300			0%
10/17/2007	Manual	0.0	0.0			0%
10/16/2007	Manual	0.0	0.0			0%
06/28/06	Manual	0.0	0.0			1%
06/27/06	Manual	0.0	0.0			0%

Prepared: djw *Checked: bko*

Table 5-3 has the information for TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s reflect this contractor's validation visits.

Table 5-3 Weight Validation History – 080200 – 30-Apr-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
04/30/08	Test Trucks	-0.9 (1.6)	-5.0 (2.9)	-0.1 (2.0)
04/29/08	Test Trucks	3.5 (1.7)	-0.1 (1.6)	4.2 (2.4)
10/17/2007	Test Trucks	0.9 (2.6)	-2.3 (4.5)	1.5 (3.9)
10/16/2007	Test Trucks	-3.5 (3.3)	-7.5 (4.7)	-2.8 (4.5)
06/28/06	Test Trucks	-0.6 (1.8)	-1.2 (3.2)	-0.5 (3.1)
06/27/06	Test Trucks	3.3 (2.4)	3.1 (2.8)	3.3 (3.2)

Prepared: djw *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

Under a separate contract with the Phase II Contractor, this site is to be visited semi-annually for routine preventive equipment diagnostics and inspection.

The system firmware needs to be corrected remotely by IRD in order to address the misclassification issue note in Section 3.3.

No other corrective actions are required at this time.

6 Pre-Validation Analysis

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on October 17, 2007. The site had equipment maintenance work performed and factor adjustments were made between our last validation visit and this one.

The factors in place at the end of our last Validation visit and those found prior to validation are shown below.

	Left Sensor 1		Right Sensors 2	
	29-Apr-2008	17-Oct-2007	29-Apr-2008	17-Oct-2007
88 kph	3466	3698	3502	3698
96 kph	3482	3715	3517	3715
104 kph	3524	3759	3558	3759
112 kph	3570	3808	3606	3808
120 kph	3566	3804	3601	3804

Prepared: djw *Checked: bko*

This Pre-Validation analysis is based on test runs conducted April 29, 2008 at test site 080200 on I-76. This SPS-2 site is at milepost 39.7 on the northbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation and for the subsequent calibration included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 75,830 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,120 lbs., the "partial" truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 61 to 74 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 58 to 93degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was also achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1.

As shown in Table 6-1, this site met all LTPP requirements for research quality loading data.

Table 6-1 Pre-Validation Results – 080200 – 29-Apr-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.1 ± 3.2%	Pass
Tandem axles	±15 percent	4.2 ± 4.9%	Pass
GVW	±10 percent	3.5 ± 3.4%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the morning and afternoon hours under mostly sunny weather conditions, resulting in range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided into 61 to 66 mph for Low speed, 67 to 70 mph for Medium speed and 71+ mph for High speed. The two temperature groups were created by splitting the runs between those at 58 to 75 degrees Fahrenheit for Low temperature, and 76 to 93 degrees Fahrenheit for High temperature.

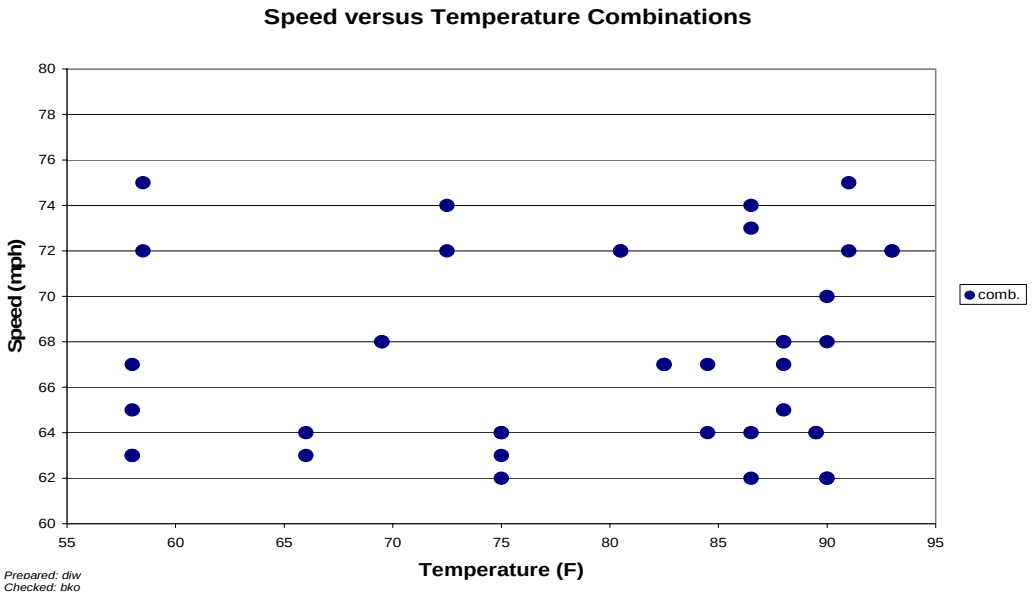

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 080200 – 29-Apr-2008

A series of graphs was developed to investigate visually for any sign of any relationship between speed or temperature and the scale performance.

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. The equipment appears to increasingly overestimate GVW as speed increases. Variability in error appears to be consistent throughout the entire speed range.

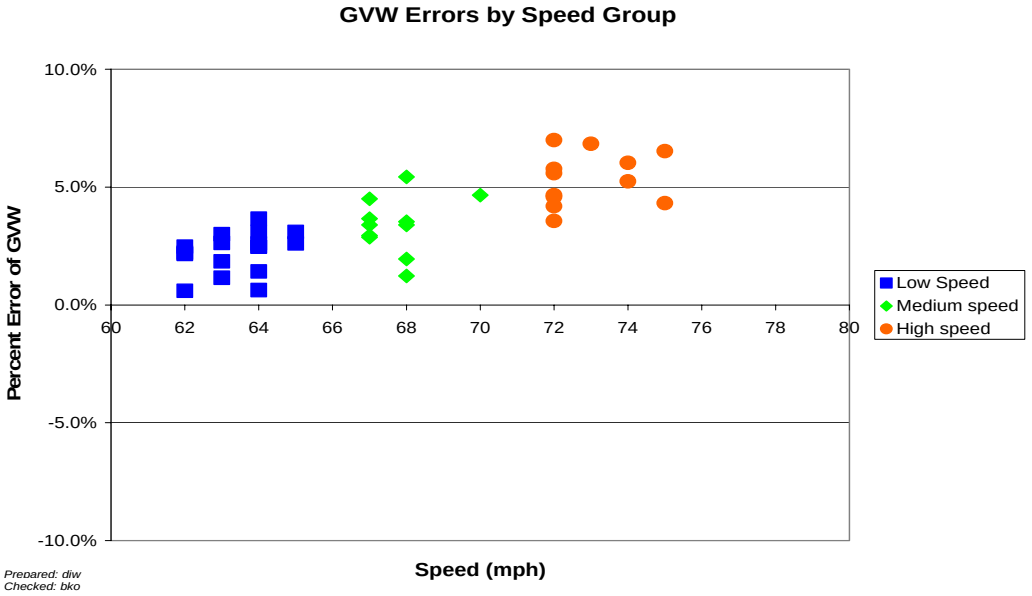

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 080200 – 29-Apr-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. From the figure, it appears that the equipment has a tendency to overestimate GVW at all pavement temperatures.

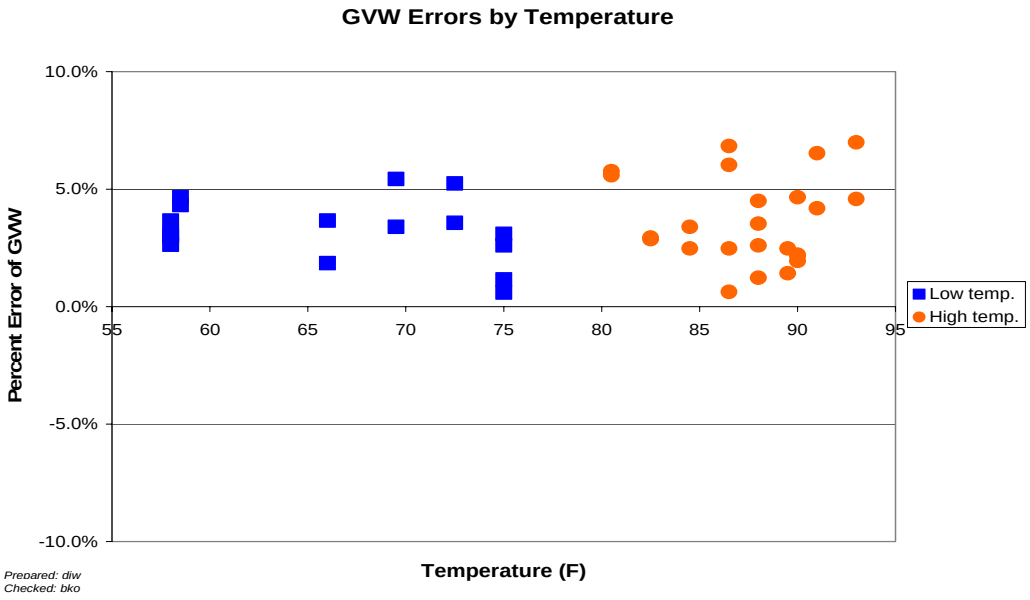

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 080200 – 29-Apr-2008

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. Axle spacing errors appear to be consistent throughout the test truck speed range and are limited to about 1.2 inches (0.1 feet). Vehicle speeds appear to have no effect on the error of measured axle spacing.

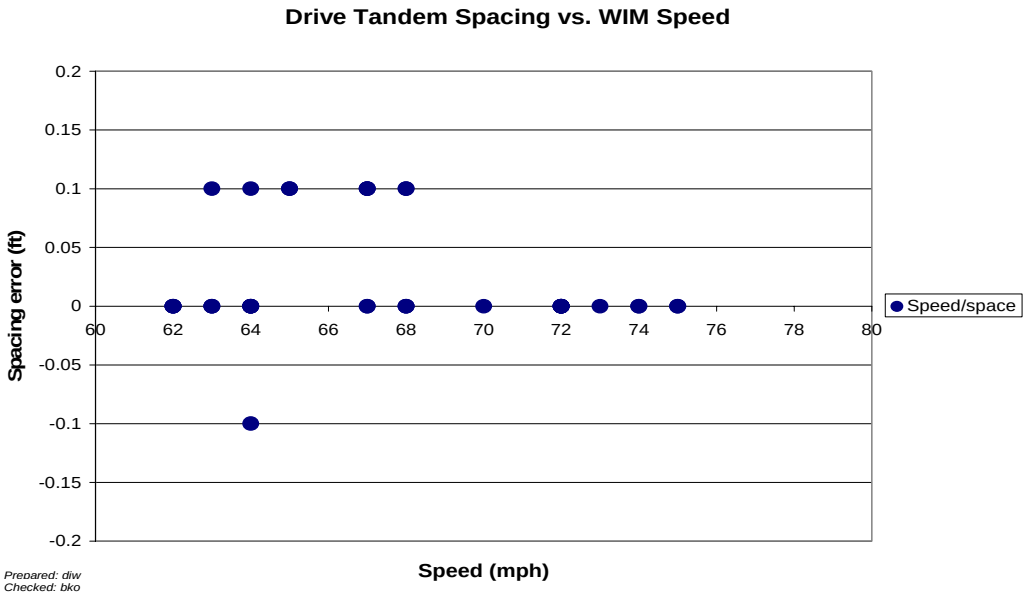

Figure 6-4 Pre-Validation Spacing vs. Speed - 080200 – 29-Apr-2008

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 58 to 75 degrees Fahrenheit for Low temperature and 76 to 93 degrees Fahrenheit for High temperature. Three groups were considered inappropriate because of the small resulting sample sizes at the low end of the range.

Table 6-2 Pre-Validation Results by Temperature Bin – 080200 – 29-Apr-2008

Element	95% Limit	Low Temperature 58 to 75 °F	High Temperature 76 to 93 °F
Steering axles	±20 %	0.1 ± 3.5%	-0.2 ± 3.2%
Tandem axles	±15 %	3.8 ± 3.8%	4.4 ± 5.5%
GVW	±10 %	3.2 ± 2.8%	3.7 ± 3.9%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

From Table 6-2, it appears that steering axle weights are estimated with reasonable accuracy and steering axle weights and GVW are overestimated at all temperatures. Variability in error appears to be reasonably consistent throughout the entire temperature range for steering axles and increase as temperature increases for tandem axle weights and GVW.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck.
The WIM equipment appears to overestimate GVW for both trucks over the course of the entire temperature range. Variation in error appears to be greater at the higher temperatures.

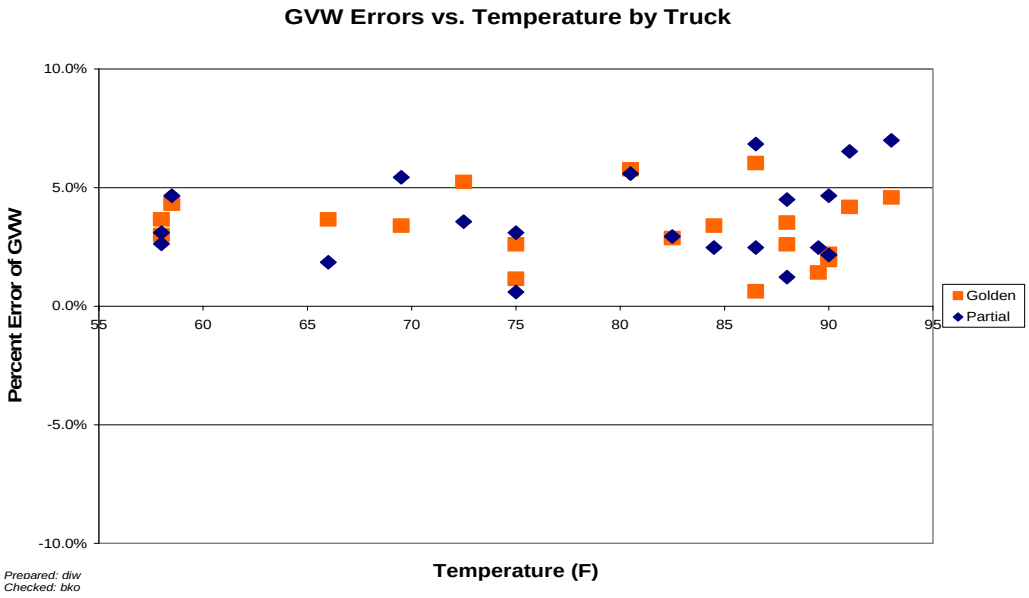

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 080200 – 29-Apr-2008

Figure 6-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. From the figure, it can be seen that the equipment estimates steering axle weights with reasonable accuracy at all temperatures. Variability in error appears to be slightly greater at the higher temperatures.

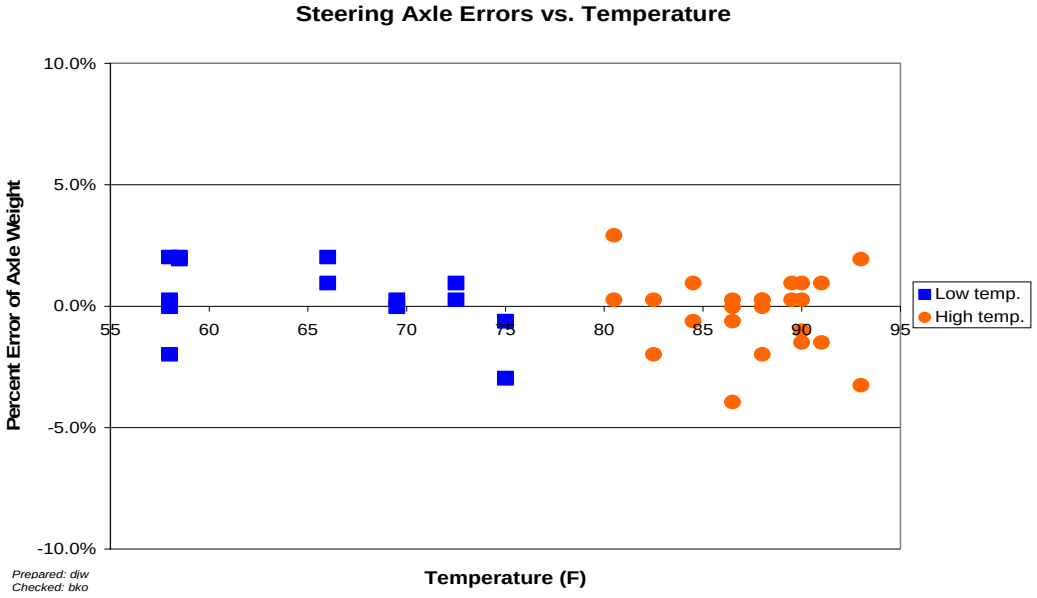

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 080200 – 29-Apr-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 61 to 66 mph, Medium speed – 67 to 70 mph and High speed – 71+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 080200 – 29-Apr-2008

Element	95% Limit	Low Speed 61 to 66 mph	Medium Speed 67 to 70 mph	High Speed 71+ mph
Steering axles	±20 %	-0.2 ± 3.1%	-0.4 ± 2.2%	0.2 ± 4.7%
Tandem axles	±15 %	2.7 ± 3.0%	4.1 ± 4.1%	6.3 ± 4.9%
GVW	±10 %	2.2 ± 1.8%	3.4 ± 2.7%	5.4 ± 2.5%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 6-3, it appears that for the truck population as a whole, overestimates of tandem weights and GVW increase as speed increases. Steering axle weights are estimated with reasonable accuracy at all speeds. Steering axle error scatter is greatest at the low and high speeds. Scatter for tandem axle weights increases as speed increases. Variability in GVW error is reasonably consistent over the entire speed range.

Figure 6-7 illustrates the tendency for the equipment to increasingly overestimate GVW for the truck population as a whole and for each truck individually as speed increases. Variability in error for the population as a whole and for the Partially Loaded Truck (diamonds) and for the Golden Truck (squares) appears to be consistent over the entire speed range. This trend did not exist at the end of the prior validation.

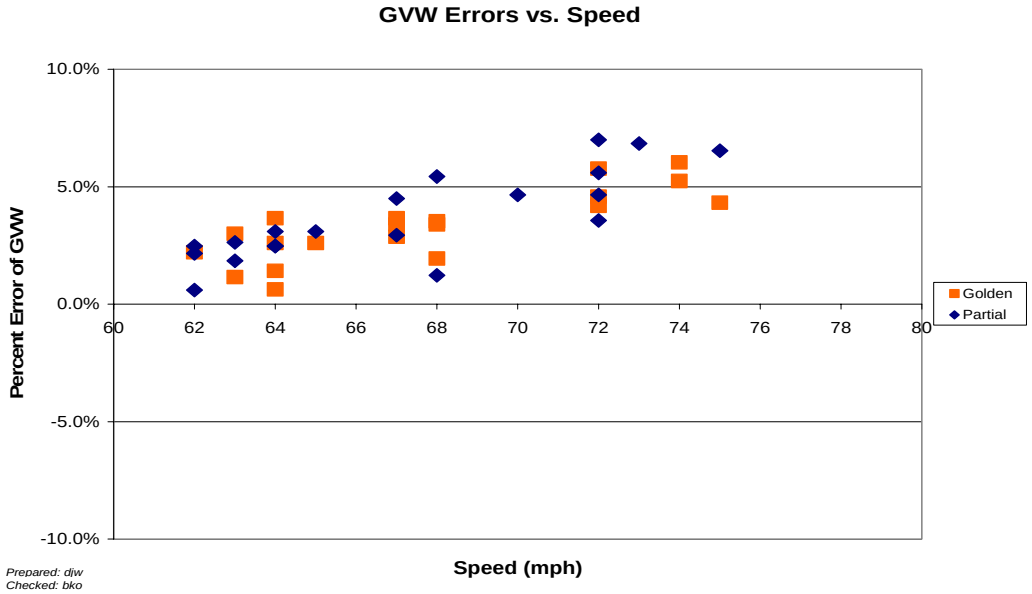

Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 080200 –29-Apr-2008

Figure 6-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. From the figure, it can be seen that the equipment overestimates steering axle weights at all speeds. Scatter of error appears to be reasonably consistent over the entire speed range.

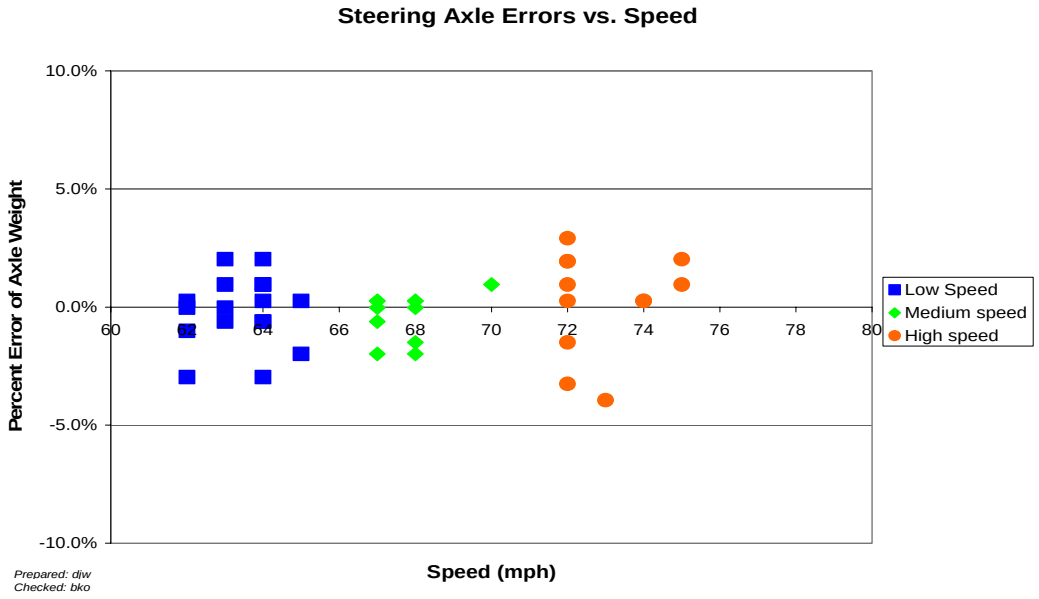

Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 080200 – 29-Apr-2008

6.3 Classification Validation

This LTPP installed site uses the FHWA 13-bin classification scheme and the LTPP ETG mod 3 classification algorithm. Classification 15 has been added to define unclassified vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on the sample it was determined that there are zero percent unknown vehicles and zero percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 6-4 has the classification error rates by class. The overall misclassification rate is 11.3 percent.

Table 6-4 Truck Misclassification Percentages for 080200 – 29-Apr-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	29	6	25
7	N/A				
8	75	9	3	10	N/A
11	0	12	N/A	13	0

Prepared: djw *Checked: bko*

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them a re matches, the error rate is 25 percent. The large misclassification percentages for Classes 4, 6 and 8 are the outcome of the small number of observations. There were two 4s, one 6 and four 8s seen in the sample. The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 6-5 Truck Classification Mean Differences for 080200 – 29-Apr-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	-100	5	0	6	- 25
7	N/A				
8	300	9	0	10	N/A
11	0	12	N/A	13	0

Prepared: djw *Checked: bko*

These error rates are normalized to represent how many vehicles of the class are expected to be over or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them or one hundred out of one hundred. Numbers 1 or larger indicate at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown are those identified by the equipment but no vehicles of the type were seen the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

A limited investigation of the precision and bias of the speeds reported by the equipment was undertaken. The values were not within the expected tolerances. Since the classification data for heavy trucks did not meet research quality standards while the spacing was within acceptable bounds, the observed bias and variability of speed are thought to be more strongly related to radar speed precision than errors in the WIM equipment.

6.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 6-6 Results of Validation Using ASTM E-1318-02 Criteria

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

Prepared: djw *Checked: bko*

6.5 Prior Validations

The last validation for this site was done October 17, 2007. It was the second validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. Note that there was no apparent trend with speed. The site was validated with two trucks. The "Golden" truck was loaded to 76,790 lbs. The "partial" truck which had air suspension on both tandems was loaded to 64,890 lbs.

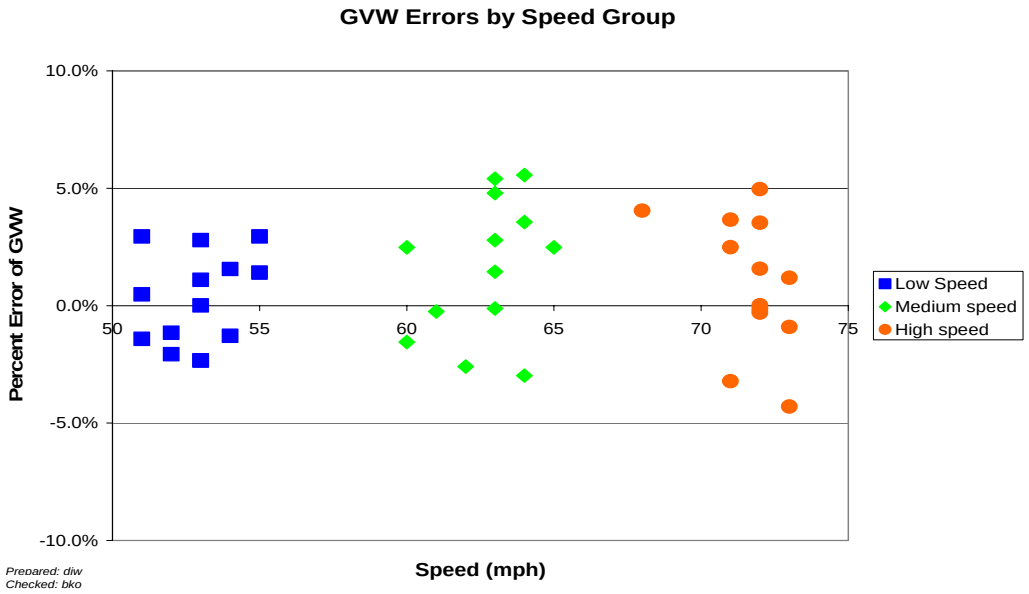

Figure 6-9 Last Validation GVW Percent Error vs. Speed – 080200 – 17-Oct-2007

Table 6-7 shows the overall results from the last validation. The bias was smaller than at the start of this validation. The scatter was greater.

Table 6-7 Last Validation Final Results – 080200 – 17-Oct-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.3 ± 9.2%	Pass
Tandem axles	±15 percent	1.5 ± 7.8%	Pass
Gross vehicle weights	±10 percent	0.9 ± 5.2%	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

Table 6-8 has the results at the end of the last validation by temperature. Through this validation the equipment has been observed at temperature from 37 to 115 degrees Fahrenheit. The equipment underestimated steering axle weights at the high temperatures during this validation.

Table 6-8 Last Validation Results by Temperature Bin – 080200 – 17-Oct-2007

Element	95% Limit	Low Temperature 37 to 50 °F	High Temperature 51 to 66 °F
Steering axles	±20 %	0.8 ± 10.2%	-3.3 ± 8.4%
Tandem axles	±15 %	1.6 ± 9.8%	1.5 ± 7.3%
GVW	±10 %	1.4 ± 6.7%	0.7 ± 5.1%
Axle spacing	± 0.5 ft	0.1 ± 0.1 ft	0.0 ± 0.2 ft

Prepared: djw *Checked: bko*

Table 6-9 has the results of the prior post validation by speed groups. The equipment underestimated steering axle weights at all speeds during this validation. Other weights were estimated with reasonable accuracy. The prior validation used a wider range of speeds, 51-75 mph than the current validation range of 61-75 mph. The change in range reflects the very low numbers of trucks at speeds below 65 mph.

Table 6-9 Last Validation Results by Speed Bin – 080200 – 17-Oct-2007

Element	95% Limit	Low Speed 51 to 57 mph	Medium Speed 58 to 67 mph	High Speed 68+ mph
Steering axles	±20 %	-2.7 ± 9.2%	-1.7 ± 10.4%	-2.4 ± 10.7%
Tandem axles	±15 %	0.8 ± 7.3%	2.2 ± 8.5%	1.4 ± 8.3%
GVW	±10 %	0.2 ± 4.3%	1.6 ± 6.4%	1.0 ± 6.1%
Axle spacing	± 0.5 ft	0.1 ± 0.2 ft	0.0 ± 0.2 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

7 Data Availability and Quality

As of April 29, 2008 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

Data that has validation information available has been reviewed in light of the patterns present in the two weeks immediately following a validation/calibration activity. A determination of research quality data is based on the consistency with the validation pattern. Data that follows consistent and rational patterns in the absence of calibration information may be considered nominally of research quality pending validation information with which to compare it. Data that is inconsistent with expected patterns and has no supporting validation information is not considered research quality.

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. **Together with the previously gathered calibration information, it can be seen that at least four additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.** Data from the previous site location has been excluded due lack of validation and verification that substantially the same truck population passed both locations.

Table 7-1 Amount of Traffic Data Available 080200 – 29-Apr-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
2006	177	8	Full Week	194	8	Full Week
2007	297	10	Full Week	299	10	Full Week

Prepared: djw *Checked: bko*

GVW graphs and characteristics associated with them are used as data screening tools. As a result classes constituting more that ten percent of the truck population are considered major sub-groups whose evaluation characteristics should be identified for use in screening. The typical values to be used for reviewing incoming data after a validation are determined starting with data from the day after the completion of a validation.

Class 5s and Class 9s constitute more than 10 percent of the truck population. Based on the data collected following this validation the following are the expected values for these populations. The precise values to be used in data review will need to be determined by the Regional Support Contractor on receipt of the first 14 days of data after the successful validation. For sites that do not meet LTPP precision requirements, this period may still be used as a starting point from which to track scale changes.

Table 7-2 is generated with a column for every vehicle class 4 or higher that represents 10 percent or more of the truck (class 4-20) population. In creating Table 7-2 the following definitions are used:

- Class 9 overweights are defined as the percentage of vehicles greater than 88,000 pounds
- Class 9 underweights are defined as the percentage of vehicles less than 20,000 pounds.
- Class 9 unloaded peak is the bin less than 44,000 pounds with the greatest percentage of trucks.

- Class 9 loaded peak is the bin 60,000 pounds or larger with the greatest percentage of trucks.
- For all other trucks the typical axle configuration is used to determine the maximum allowable weight based on 18,000 pounds for single axles and 34,000 pounds for tandem axles. A ten percent cushion above that maximum is used to set the overweight threshold.
- For all other trucks in the absence of site specific information the computation of under weights assumes the power unit weighs 10,000 pounds and each axle on a trailer 5,000 pounds. Ninety percent of the total for the unloaded configuration is the value below which a truck is considered under weight.
- For all trucks other than class 9s that have a bi-modal distribution the unloaded peak is defined to be in a bin less than or equal to half of the allowable maximum weight.
- For all trucks other than class 9s that have a bi-modal distribution the loaded peak is defined to be in a bin greater than or equal to half of the allowable maximum weight.

There may be more than one bin identified for the unloaded or loaded peak due to the small sample size collected after validation. Where only one peak exists, the peak rather than a loaded or unloaded peak is identified. This may happen with single unit trucks. It is not expected to occur with combination vehicles.

Table 7-2 GVW Characteristics of Major sub-groups of Trucks – 080200 – 30-Apr-2008

Characteristic	Class 9	Class 5
Percentage Overweights	0.3 %	0.0 %
Percentage Underweights	0.0 %	1.5 %
Unloaded Peak	28,000 lbs	
Loaded Peak	73,000 lbs	
Peak		12,000 lbs

Prepared: djw *Checked: bko*

The expected percentage of unclassified vehicles is 2.1 %. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-2 through Figure 7-4. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the Post-Validation period.

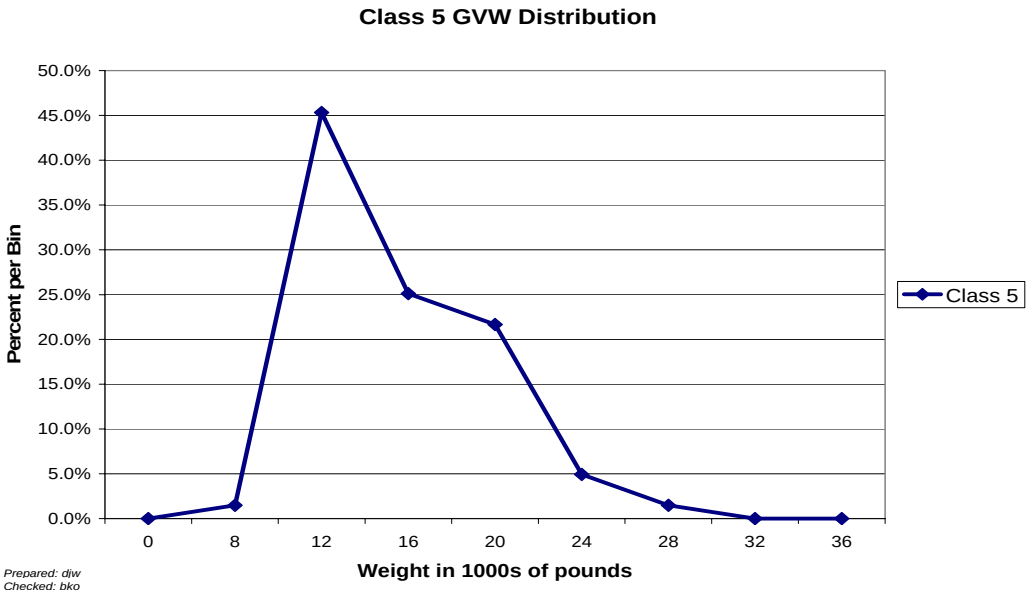

Figure 7-1 Expected GVW Distribution Class 5 – 080200 – 30-Apr-2008

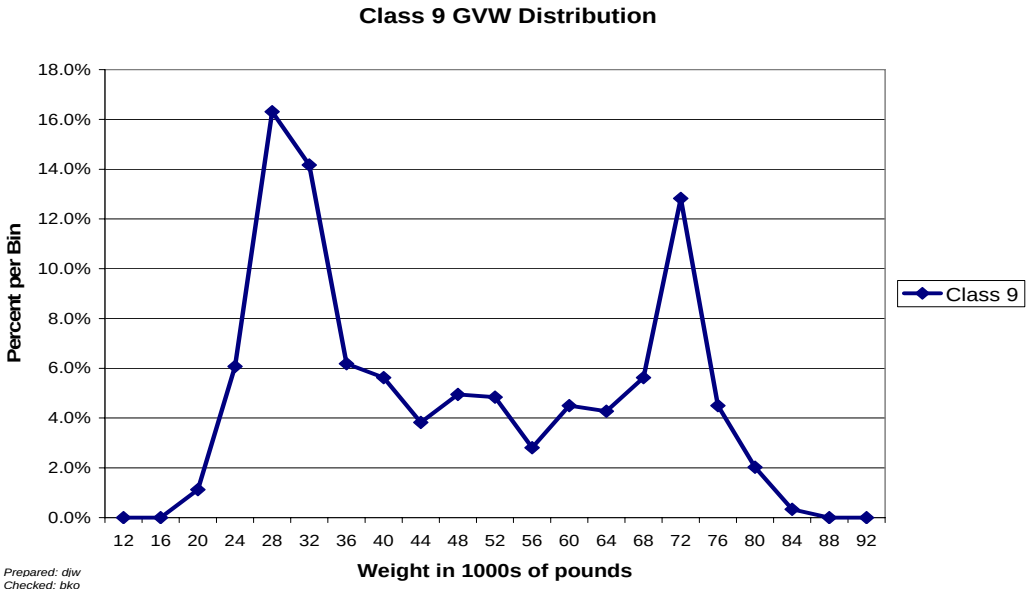

Figure 7-2 Expected GVW Distribution Class 9 – 080200 – 30-Apr-2008

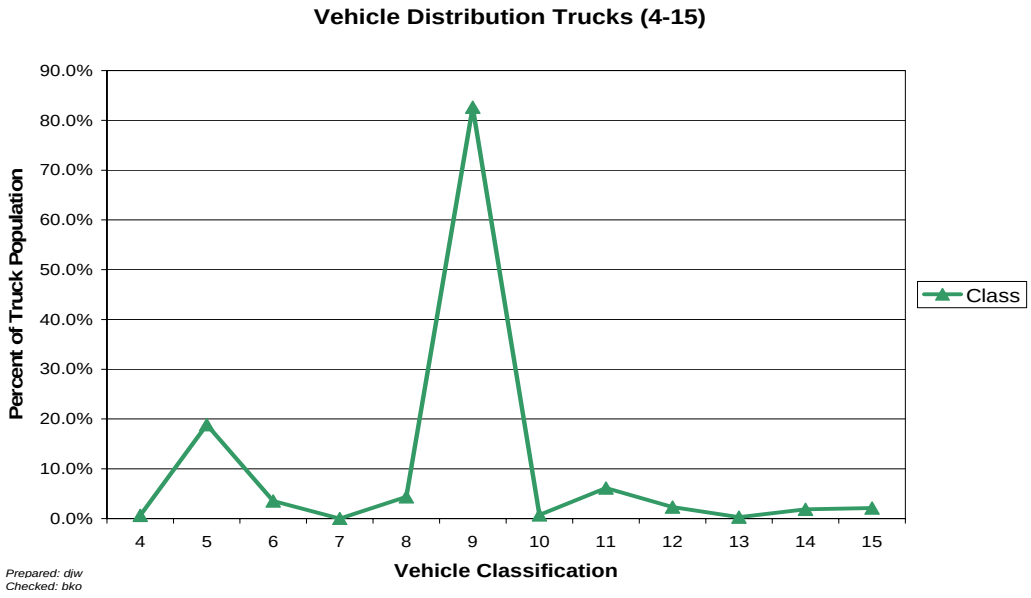

Figure 7-3 Expected Vehicle Distribution – 080200 – 30-Apr-2008

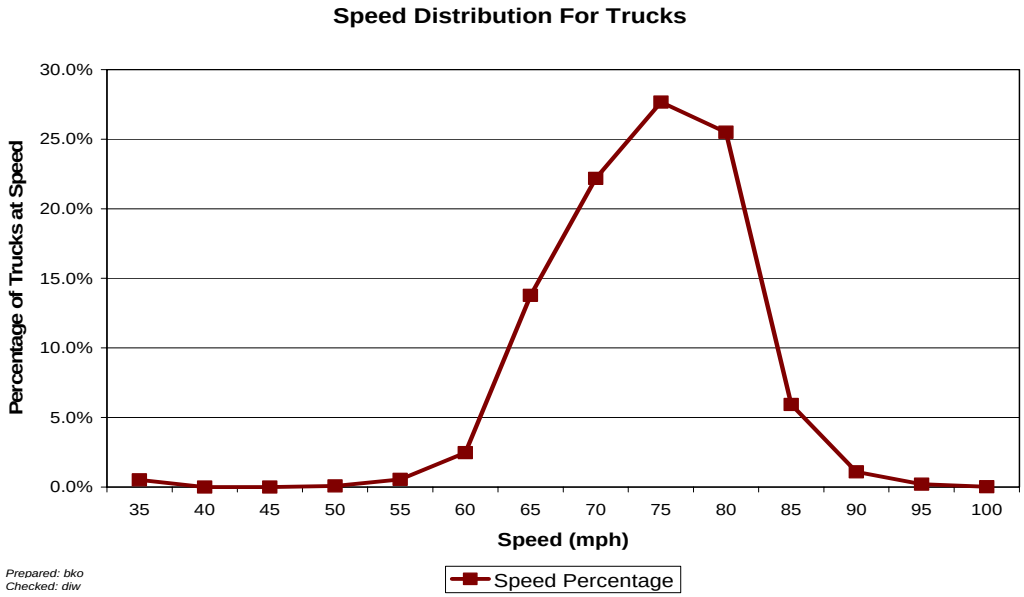

Figure 7-4 Expected Speed Distribution – 080200 – 30-Apr-2008

8 Data Sheets

The following is a listing of data sheets incorporated in Appendix A.

Sheet 19 – Truck 1 – 3S2 loaded air suspension (3 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded air suspension (3 pages)

Sheet 20 – Speed and Classification verification Pre-Validation (2 pages)
Sheet 20 – Speed and Classification verification – Post-Validation (2 pages)

Sheet 21 – Pre-Validation (3 pages)
Sheet 21 – Calibration Iteration 1 – (1 page)
Sheet 21 – Post-Validation (2 pages)

Calibration Iteration 1 Worksheets – (1 page)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following this page. It includes a current Sheet 17 with all applicable maps and photographs.

10 Updated Sheet 18

A current Sheet 18 indicating the contacts, conditions for assessments and evaluations has been attached following the updated handout guide.

11 Traffic Sheet 16(s)

Sheet 16s for the pre-validation and post-validation conditions are attached following the current Sheet 18 information at the very end of the report.

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Colorado

SHRP ID: 080200

Figures

Photos

1. General Information

SITE ID: *080200*

LOCATION: *Interstate 76 East at M.P. 39.7*

VISIT DATE: *April 29 & 30, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

Assessment Team Leader: *Dean J. Wolf, 301-210-5105, djwolf@mactec.com*

Highway Agency: *Skip Outcalt, 303-757-9984, skip.outcalt@dot.state.co.us*

Liz Stolz, 303- 757-9495, elizabeth.stolz@dot.state.co.us

Dave Smith, 303-757-9816, david.e.smith@dot.state.co.us

Roberto DeDios, 303-757-9975, Roberto.DeDios@dot.state.co.us

FHWA COTR: *Debbie Walker, 202-493-3068, deborah.walker@fhwa.dot.gov*

FHWA Division Office Liaison: *Donna Harmelink, 720-963-3021, donna.harmelink@fhwa.dot.gov*

LTPP SPS WIM WEB PAGE: *http://www.tfhrc.gov/pavement/ltpp/spstraffic/index.htm*

3. Agenda

BRIEFING DATE: *Briefing not requested for this visit.*

ON SITE PERIOD: *April 29th and 30th, 2008, beginning at 9:00 a.m.*

TRUCK ROUTE CHECK: *See truck route.*

4. Site Location/ Directions

NEAREST AIRPORT: *Denver International Airport, Denver, Colorado*

DIRECTIONS TO THE SITE: *I-76, approximately 1.0 mile East of Exit 39 (Keenesburg)*

MEETING LOCATION: *April 29th, 2008, on site beginning at 9.00 a.m.*

WIM SITE LOCATION: *Interstate 76 East at M.P. 39.7 (Latitude: N 40.1183^0 and Longitude: W -104.5083^0)*

WIM SITE LOCATION MAP: *See Figure 4.1*

Figure 4-1 - Site 080200 in Colorado

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *Tomahawk Truck Stops, 12060 Sable Blvd, Brighton, CO, I-76, exit 17; Latitude: 39.9154^0, Longitude: -104.8181^0; Phone No: (303) 659-0810, open 24 hours and 7days a week, $8.00 per weight.*

TRUCK ROUTE:

North to Exit 48, approximately 8.3 miles from the site
South to Exit 34, approximately 5.4 miles from the site

Total miles = 27.4

Total time = 25 minutes

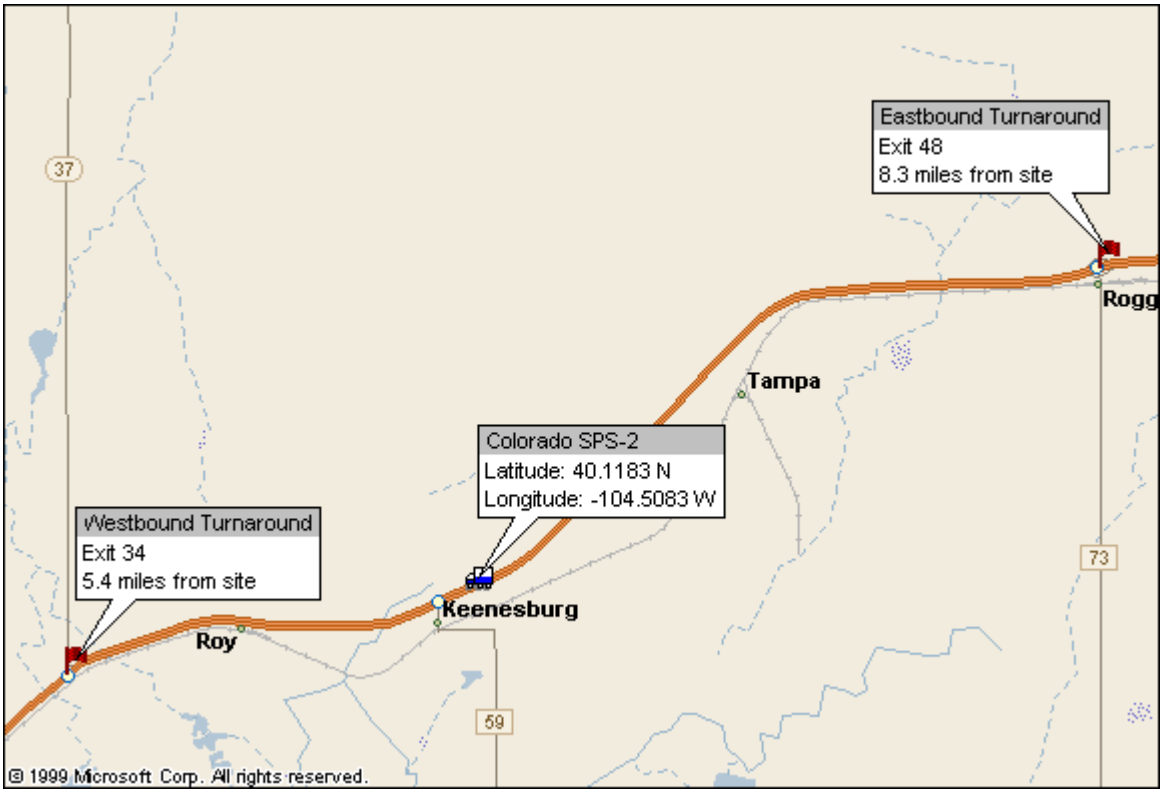

Figure 5-1 - Truck Route for 080200 in Colorado

6. Sheet 17 – Colorado (080200)

1.* ROUTE ___I-76___MILEPOST _39.7____LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade ___<1___ % Sag vertical Y / N
Nearest SPS section upstream of the site __0_8_0_2_2_3__
Distance from sensor to nearest upstream SPS Section __1_9_._2__ miles

3.* LANE CONFIGURATION
Lanes in LTPP direction _2___ Lane width _1_2_ ft

Median - 1 – painted
2 – physical barrier
3 – grass
4 – none

Shoulder - 1 – curb and gutter
2 – paved AC
3 – paved PCC
4 – unpaved
5 – none

Shoulder width __1_0__ ft

4.* PAVEMENT TYPE ____PCC_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _4/29/2008_ Photo Filename: _08_0200_Upstream_04_29_08_____
Date __4/29/2008_ Photo Filename: _08_0200_Downstream_04_29_08_____
Date _____Distress Photo Filename _____

6. * SENSOR SEQUENCE _____Loop – Bending Plate – Bending Plate - Loop_____

7. * REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __

8. RAMPS OR INTERSECTIONS
Intersection/driveway within 300 m upstream of sensor location Y / N
distance _____
Intersection/driveway within 300 m downstream of sensor location Y / N
distance _____
Is shoulder routinely used for turns or passing? Y / N

9. DRAINAGE (*Bending plate and load cell systems only)*
1 – Open to ground
2 – Pipe to culvert
3 – None

Clearance under plate ___ __ 4.0 ___ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

Same side of road as LTPP lane Y / N Median Y/ N Behind barrier Y / N
Distance from edge of traveled lane _4_5__ ft
Distance from system _5_5_ __ ft
TYPE ____M_____

CABINET ACCESS controlled by LTPP / STATE / JOINT?
Contact - name and phone number _Dave Price (303) 757-9976_____
Alternate - name and phone number_Liz Stulz (303) 757-9495 ___

11. * POWER

Distance to cabinet from drop _2_8_7_____ ft Overhead / underground / solar /
AC in cabinet?
Service provider _____ Phone number_____

12. * TELEPHONE

Distance to cabinet from drop __2_2_8___ ft Overhead / underground / cell?
Service provider _____ Phone Number_____

13.* SYSTEM (software & version no.)-___iSINC_____
Computer connection – RS232 / Parallel port / USB / Other _____

14. * TEST TRUCK TURNAROUND time __25__ minutes DISTANCE _28_ mi.

15. PHOTOS FILENAME

Power source	08_0200_Power_Meter_04_29_08.jpg
Phone source	08_0200_Telephone_Source_04_29_08.jpg
Cabinet exterior	08_0200_Cabinet_Exterior_04_29_08.jpg
Cabinet interior	08_0200_Cabinet_Interior_Front_04_29_08.jpg
	08_0200_Cabinet_Interior_Back_04_29_08.jpg
Weight sensors	08_0200_Leading_WIM_Sensor_04_29_08.jpg
	08_0200_Trailing_WIM_Sensor_04_29_08.jpg
Other sensors	08_0200_Leading_Loop_04_29_08.jpg
	08_0200_Trailing_Loop_04_29_08.jpg

Description Loops _____
Downstream direction at sensors on LTPP lane:
_____08_0.200_Downstream_04_29_2008.jpg_____
Upstream direction at sensors on LTPP lane:
_____08_02.00_Upstream_04_29_2008.jpg_____

COMMENTS

_____Gas/Restaurants at exit 39, approximately 1 mile west of site_____

_ Louis County Stop I-76 exit 31 (HWY 52) Hudson, CO -40.078140 N /104.648160 W

COMPLETED BY _____Dean J. Wolf_____

PHONE __301-210-5105__DATE COMPLETED _04 _ _ /_29 _ _ / _2008 _ _ _ _

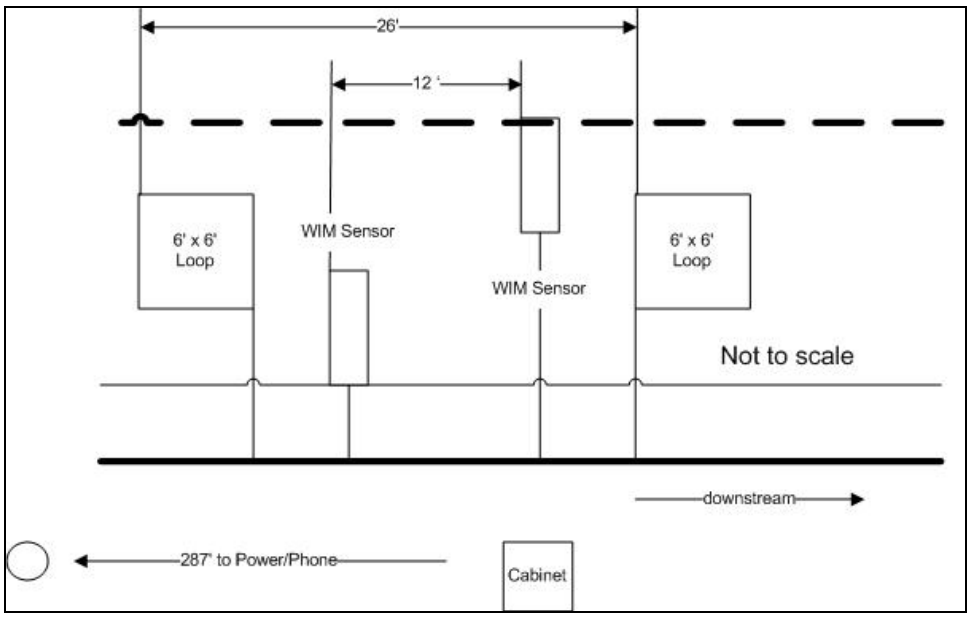

Figure 6-1 Sketch of equipment layout

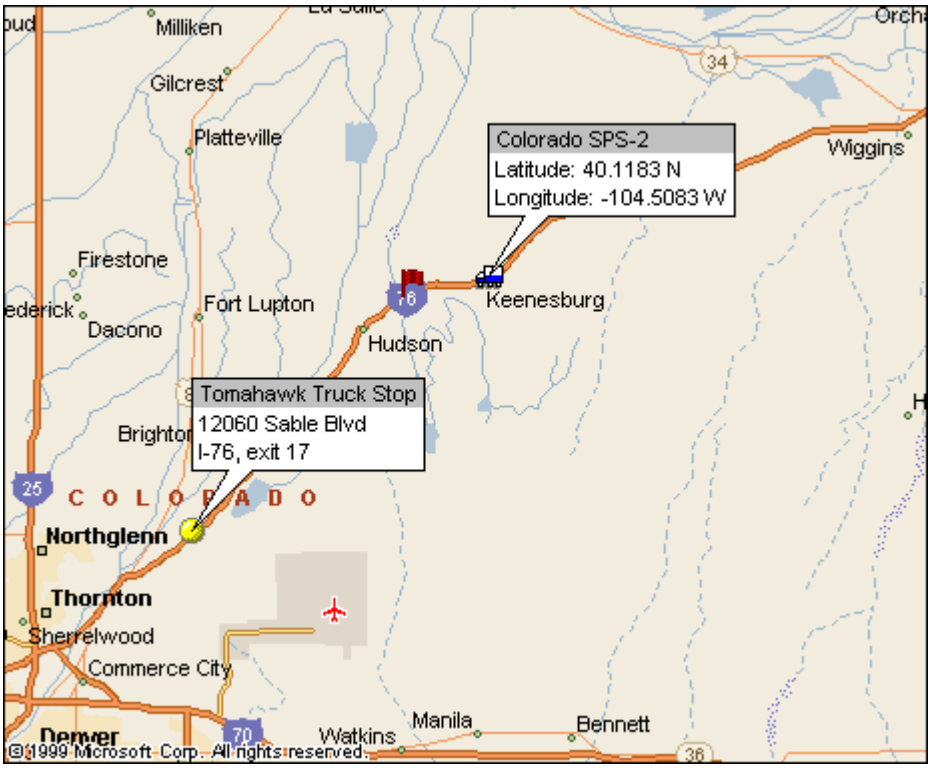

Figure 6-2 - Site Map for 080200 in Colorado

Photo 1 08_0200_Upstream_04_29_08.jpg

Photo 2 08_0200_Downstream_04_29_08.jpg

Photo 3 08_0200_Power_Meter_04_29_08.jpg

Photo 4 08_0200_Telephone_Source_04_29_08.jpg

Photo 5 08_0200_Cabinet_Exterior_04_29_08.jpg

Photo 6 08_0200_Cabinet_Interior_Front_04_29_08.jpg

Photo 7 08_0200_Cabinet_Interior_Back_04_29_08.jpg

Photo 8 08_0200_Leading_WIM_Sensor_04_29_08.jpg

Photo 9 08_0200_Trailing_WIM_Sensor_04_29_08.jpg

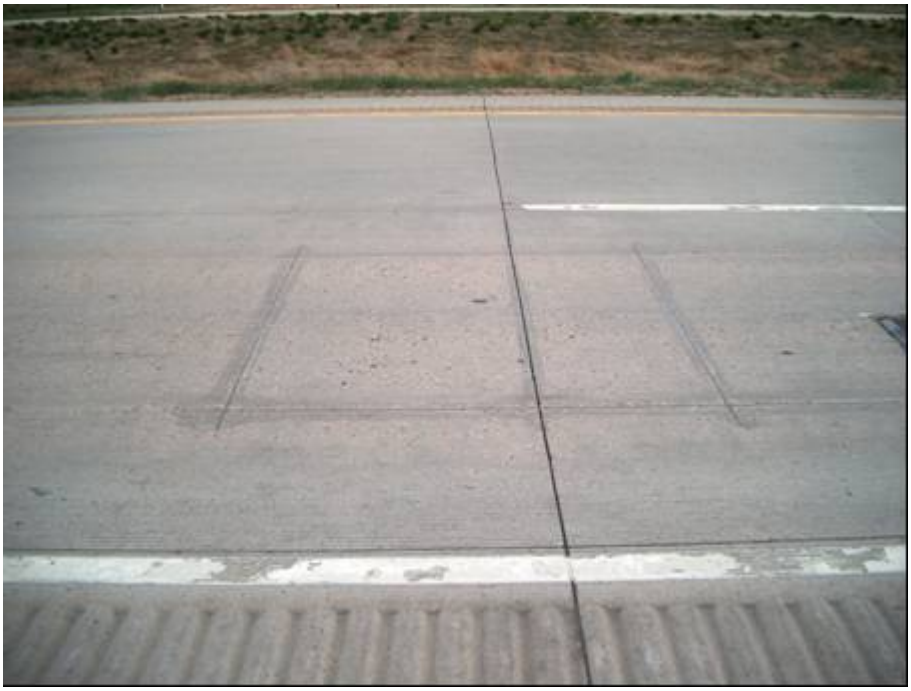

Photo 10 08_0200_Leading _Loop-Sensor_04_29_08.jpg

Photo 11 08_0200_Trailing_Loop_Sensor_04_29_08.jpg

SHEET 18	STATE CODE [08]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 4/29/2008

Rev. 05/15/07

1. DATA PROCESSING –
   a. Down load –
      - ☐ State only
      - ☐ LTPP read only
      - ☐ LTPP download
      - ☒ LTPP download and copy to state

   b. Data Review –
      - ☐ State per LTPP guidelines
      - ☐ State – ☐ Weekly ☐ Twice a Month ☐ Monthly ☐ Quarterly
      - ☒ LTPP

   c. Data submission –
      - ☐ State – ☐ Weekly ☐ Twice a month ☐ Monthly ☐ Quarterly
      - ☒ LTPP

2. EQUIPMENT –
   a. Purchase –
      - ☐ State
      - ☒ LTPP

   b. Installation –
      - ☐ Included with purchase
      - ☐ Separate contract by State
      - ☐ State personnel
      - ☒ LTPP contract

   c. Maintenance –
      - ☐ Contract with purchase – Expiration Date _____
      - ☒ Separate contract LTPP – Expiration Date _5/31/2011_
      - ☐ Separate contract State – Expiration Date _____
      - ☐ State personnel

   d. Calibration –
      - ☐ Vendor
      - ☐ State
      - ☒ LTPP

   e. Manuals and software control –
      - ☐ State
      - ☒ LTPP

   f. Power –
      i. Type –
         - ☐ Overhead
         - ☒ Underground
         - ☐ Solar

      ii. Payment –
         - ☒ State
         - ☐ LTPP
         - ☐ N/A

g. Communication –

i. Type –
- ☒ Landline
- ☐ Cellular
- ☐ Other

ii. Payment –
- ☒ State
- ☐ LTPP
- ☐ N/A

3. PAVEMENT –

a. Type –
- ☒ Portland Concrete Cement
- ☐ Asphalt Concrete

b. Allowable rehabilitation activities –
- ☒ Always new
- ☐ Replacement as needed
- ☐ Grinding and maintenance as needed
- ☐ Maintenance only
- ☐ No remediation

c. Profiling Site Markings –
- ☐ Permanent
- ☒ Temporary

4. ON SITE ACTIVITIES –

a. WIM Validation Check - advance notice required _7__ ☒ days ☐ weeks

b. Notice for straightedge and grinding check - _____ ☐ days ☒ weeks

i. On site lead –
- ☐ State
- ☒ LTPP

ii. Accept grinding –
- ☐ State
- ☒ LTPP

c. Authorization to calibrate site –
- ☐ State only
- ☒ LTPP

d. Calibration Routine –
- ☒ LTPP – ☐ Semi-annually ☒ Annually
- ☐ State per LTPP protocol – ☐ Semi-annually ☐ Annually
- ☐ State other – _____

e. Test Vehicles
   i. Trucks –
      1st – Air suspension 3S2 ☐ State ☒ LTPP
      2nd – _3S2 different weight/suspension__ ☐ State ☒ LTPP
      3rd – _____ ☐ State ☐ LTPP
      4th – _____ ☐ State ☐ LTPP
   ii. Loads – ☐ State ☒ LTPP
   iii. Drivers – ☐ State ☒ LTPP

f. Contractor(s) with prior successful experience in WIM calibration in state:

_ _

g. Access to cabinet
   i. Personnel Access –
      ☐ State only
      ☒ Joint
      ☐ LTPP
   ii. Physical Access –
      ☒ Key
      ☐ Combination

h. State personnel required on site – ☐Yes ☒No

i. Traffic Control Required – ☐Yes ☒No

j. Enforcement Coordination Required – ☐Yes ☒No

5. SITE SPECIFIC CONDITIONS –
   a. Funds and accountability – _____
   b. Reports – _____
   c. Other – _____
   d. Special Conditions – _____

6. CONTACTS –
   a. Equipment (operational status, access, etc.) –

      Name: Roy Czinku Phone:(306) 653-6627

      Agency: IRD

b. Maintenance (equipment) –

Name: Debbie Walker Phone (202)249-3068

Agency: FHWA

c. Data Processing and Pre-Visit Data –

Name: LTPP Customer Service Email: ltppinfo@fhwa.dot.gov

Agency: FHWA

d. Construction schedule and verification –

Name: Dave Smith Phone:303.757.9816

Skip Outcalt 303.757.9984

Agency: Colorado DOT

e. Test Vehicles (trucks, loads, drivers) –

Name: Jim Sweetman Phone:303.289.2152

Agency: Sweetman Enterprises, Inc.

f. Traffic Control –

Name: Phone:

Agency:

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: Love's Country Stop Location:Love's Country Stop I-76 exit 31 Hwy 52 Hudson, Co 40.078140 N - 104.648160 W

Phone: _____

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [08] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [4/29/2008]

2. * TYPE OF EQUIPMENT CALIBRATED ____ WIM ____ CLASSIFIER _X_ BOTH

3. * REASON FOR CALIBRATION
   - ____ REGULARLY SCHEDULED SITE VISIT
   - ____ EQUIPMENT REPLACEMENT
   - ____ DATA TRIGGERED SYSTEM REVISION
   - ____ RESEARCH
   - ____ TRAINING
   - ____ NEW EQUIPMENT INSTALLATION
   - _X__ OTHER (SPECIFY) ___LTPP Validation_____

4. * SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   - ____ BARE ROUND PIEZO CERAMIC
   - ____ BARE FLAT PIEZO
   - _X__ BENDING PLATES
   - ____ CHANNELIZED ROUND PIEZO
   - ____ LOAD CELLS
   - ____ QUARTZ PIEZO
   - ____ CHANNELIZED FLAT PIEZO
   - _X__ INDUCTANCE LOOPS
   - ____ CAPACITANCE PADS
   - ____ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

____ TRAFFIC STREAM -- ____STATIC SCALE (Y/N) _X__ TEST TRUCKS

___ NUMBER OF TRUCKS COMPARED __ 2__ NUMBER OF TEST TRUCKS USED

__ 20__ PASSES PER TRUCK

TYPE PER FHWA 13 BIN SYSTEM
SUSPENSION: 1 - AIR; 2 - LEAF SPRING
3 - OTHER (DESCRIBE)

TRUCK	TYPE	SUSPENSION
1	___9_____	___1_____
2	___9_____	___1_____
3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   - DYNAMIC AND STATIC GVW ___3.5 STANDARD DEVIATION ___1.7
   - DYNAMIC AND STATIC SINGLE AXLES ___-0.1 STANDARD DEVIATION ___1.6
   - DYNAMIC AND STATIC DOUBLE AXLES ___4.2 STANDARD DEVIATION ___2.4

8. 3 ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _65_ __70__ __75_ _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3601/3566___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _N_
   IF YES, LIST AND DEFINE AUTO-CALIBRATION VALUE: _____
   _____
   _____

CLASSIFIER TEST SPECIFICS***

12.*** METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
   ____ VIDEO _X_ MANUAL ____ PARALLEL CLASSIFIERS

13. METHOD TO DETERMINE LENGTH OF COUNT ____ TIME _X_ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
   - *** FHWA CLASS 9 ____ 0
   - *** FHWA CLASS 8 ____ 300
   - FHWA CLASS _5_ ____ ____ 0
   - FHWA CLASS ____ ____ ____ _____
   - FHWA CLASS ____ ____ ____ _____
   - FHWA CLASS ____ ____ ____ _____
   - *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [08] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [4/30/2008]

2. * TYPE OF EQUIPMENT CALIBRATED ___ WIM ___ CLASSIFIER _X_ BOTH

3. * REASON FOR CALIBRATION
   ___ REGULARLY SCHEDULED SITE VISIT ___ RESEARCH
   ___ EQUIPMENT REPLACEMENT ___ TRAINING
   ___ DATA TRIGGERED SYSTEM REVISION ___ NEW EQUIPMENT INSTALLATION
   _X_ OTHER (SPECIFY) ___LTPP Validation_____

4. * SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   ___ BARE ROUND PIEZO CERAMIC ___ BARE FLAT PIEZO _X_ BENDING PLATES
   ___ CHANNELIZED ROUND PIEZO ___ LOAD CELLS ___ QUARTZ PIEZO
   ___ CHANNELIZED FLAT PIEZO _X_ INDUCTANCE LOOPS ___ CAPACITANCE PADS
   ___ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:
   ___ TRAFFIC STREAM -- ___STATIC SCALE (Y/N) _X_ TEST TRUCKS

   ___ NUMBER OF TRUCKS COMPARED __ 2__ NUMBER OF TEST TRUCKS USED

   __ 20__ PASSES PER TRUCK

   TYPE PER FHWA 13 BIN SYSTEM
   SUSPENSION: 1 - AIR; 2 - LEAF SPRING
   3 - OTHER (DESCRIBE)

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	1
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW -0.9 STANDARD DEVIATION 1.6
   DYNAMIC AND STATIC SINGLE AXLES -5.0 STANDARD DEVIATION 2.9
   DYNAMIC AND STATIC DOUBLE AXLES -0.1 STANDARD DEVIATION 2.0

8. 3 ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ 65 70 75 _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3419/3306___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _N_
   IF YES, LIST AND DEFINE AUTO-CALIBRATION VALUE: _____
   _____
   _____

CLASSIFIER TEST SPECIFICS***

12.*** METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
   ___ VIDEO _X_ MANUAL ___ PARALLEL CLASSIFIERS

13. METHOD TO DETERMINE LENGTH OF COUNT ___ TIME _2_ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
   *** FHWA CLASS 9 ____ -4 FHWA CLASS _5_ ____ ____ -22
   *** FHWA CLASS 8 ____ 0 FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 5.0

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

APPENDIX A

Sheet 19	* STATE_CODE	0 8
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	04/29/02

Rev. 08/31/01

PART I.

Bill
truck 55 SW55
trailer 2026

1.* FHWA Class 9 2.* Number of Axles 5 Number of weight days 2

AXLES - units - (lbs) / 100s lbs / kg

GEOMETRY

8 a) * Tractor Cab Style - Cab Over Engine / (Conventional) b) * Sleeper Cab? Y / (N)

9. a) * Make: Peterbilt b) * Model: _____

10.* Trailer Load Distribution Description:

concrete blocks

11. a) Tractor Tare Weight (units): _____

b). Trailer Tare Weight (units): _____

12.* Axle Spacing – units m / feet and inches / feet and tenths

A to B 17.7 B to C 4.3 C to D 27.1

D to E 3.1 E to F _____

Wheelbase (measured A to last) _____ Computed 53

13. *Kingpin Offset From Axle B (units) +.6 (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	2 Full Leaf
B	11R24.5	Air
C	11R24.5	Air
D	11R24.5	Air
E	11R24.5	Air
F		

Sheet 19	* STATE_CODE	0 8
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	04 | 29 | 08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 76250
*c) Post Test Loaded Weight 75400
*d) Difference Post Test – Pre-test -850

Table 5. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11680	15660	15660	16620	16620		76240
2	11580	15740	15740	16600	16600		76260
3							
Average	11630	15700	15700	16610	16610		76250

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Table 7. Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11200	15530	15530	16570	16570		75400
2	11020	15660	15660	16530	16530		75400
3							
Average	11110	15595	15595	16550	16550		75400

Measured By DW Verified By [illegible] Weight date 4/29/08

Sheet 19	* STATE_CODE	0 8
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	04/30/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 76260

*c) Post Test Loaded Weight 75520

*d) Difference Post Test – Pre-test -740

Table 5.2. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11520	15840	15840	16530	16530		76260
2	11660	15720	15720	16580	16580		76260
3							
Average	11590	15780	15780	16555	16555		76260

Table 6.2. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11200	15670	15670	16490	16490		75520
2	11340	15570	15570	16520	16520		75520
3							
Average	11270	15620	15620	16505	16505		75520

Measured By _____ Verified By _____ Weight date 4/30/08

Sheet 19	* STATE_CODE	0 8
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	9 | 29 | 08

Rev. 08/31/01

truck SW36

PART I.

1.* FHWA Class 9 2.* Number of Axles 5 Number of weight days 2

AXLES - units - (lbs) / 100s lbs / kg

GEOMETRY

8 a) * Tractor Cab Style - Cab Over Engine / (Conventional) b) * Sleeper Cab? Y / (N)

9. a) * Make: Kenworth b) * Model: _____

10.* Trailer Load Distribution Description:

Double Bodies

11. a) Tractor Tare Weight (units): _____

b). Trailer Tare Weight (units): _____

12.* Axle Spacing – units m / feet and inches / ~~feet and tenths~~

A to B 17.8 B to C 4.3 C to D 29.6

D to E 4.0 E to F _____

Wheelbase (measured A to last) _____ Computed 50.7

13. *Kingpin Offset From Axle B (units) 1.4' (_____)
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	2 FOR LEAF
B	11R24.5	AIR
C	11R24.5	AIR
D	11R24.5	AIR
E	11R24.5	AIR
F		

Sheet 19	* STATE_CODE	0 8
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	04/29/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 64530 BW ~~64525~~
*c) Post Test Loaded Weight 63700
*d) Difference Post Test – Pre-test ~~-870~~ -830 BW

Table 5. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10460	13760	13760	13290	13290		64560
2	10510	13850	13850	~~13148~~ 13145 BW	~~13148~~ 13145		~~64490~~ 64500 BW
3							
Average	10485	13805	13805	~~13215~~ 13218 BW	~~13215~~ 13218		~~64525~~ 64530 BW

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Table 7. Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9900	13690	13690	13210	13210		63700
2	9940	13650	13650	13230	13230		63700
3							
Average	9920	13670	13670	13220	13220		63700

Measured By DJW Verified By [signature] Weight date 04/29/08

Sheet 19	* STATE_CODE	0 8
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	04/30/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 64590

*c) Post Test Loaded Weight 63840

*d) Difference Post Test – Pre-test -670

Table 5.2. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10440	13760	13760	13270	13270		64500
2	10420	13760	13760	13290	13290		64520
3							
Average	10430	13760	13760	13280	13280		64510

Table 6.2. Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10160	13600	13600	13240	13240		63840
2	10100	13630	13630	13240	13240		63840
3							
Average	10130	13615	13615	13240	13240		63840

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Measured By DJW Verified By [signature] Weight date 4/30/08

Sheet 20	* STATE_CODE	08
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 1 of* 2	* DATE	04/29/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
69	9	26482	65	9	68	9	574	69	9
72	9	26483	65	9	76	5	577	75	5
77	9	489	76	9	62	11	580	69	11
68	9	490	68	9	70	9	584	71	9
64	9	491	68	9	64	9	586	65	9
66	5	492	66	5	76	6	589	77	6
73	9	495	73	9	65	9	595	66	9
62	8	499	67	5	60	9	596	61	9
74	9	503	74	9	65	9	602	65	9
66	9	504	65	9	73	5	603	74	5
71	9	506	70	9	68	9	608	69	9
65	9	511	66	9	69	9	612	70	9
72	9	515	74	6	70	9	615	70	9
73	9	516	73	9	75	9	617	76	9
64	9	520	65	9	65	9	620	65	9
65	9	523	66	9	70	9	621	71	9
70	9	524	70	9	71	9	622	71	9
78	9	526	79	9	62	9	627	62	9
69	9	536	69	9	65	9	629	66	9
75	5	556	75	5	66	9	631	67	9
68	11	558	68	11	74	9	637	75	9
69	9	562	68	9	64	9	656	69	9
71	9	563	71	9	65	9	660	66	9
66	5	566	65	5	68	9	661	68	9
77	9	571	77	9	72	9	662	72	9

RV -

Recorded by R. Platt Direction EB Lane 1 Time from 9:45 to 10:25

Sheet 20	* STATE_CODE	08
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 2 of* 2	* DATE	04/29/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	9	26672	65	9	66	9	26789	66	9
67	9	26674	70	9	67	9	792	68	9
59	9	677	59	9	73	9	795	75	9
77	9	706	77	9	70	9	796	70	9
67	9	708	67	9	75	9	797	75	9
72	9	710	72	9	74	9	798	75	9
72	9	713	73	9	74	8	801	74	5
70	9	718	67	9	77	9	805	76	9
70	9	723	71	9	66	8	808	66	9
64	9	731	65	9	69	9	809	69	9
68	5	732	68	5	66	9	811	67	9
68	5	738	69	5	85	9	814	79	9
72	9	739	72	9	78	9	827	79	9
78	13	757	78	13	76	9	834	76	9
64	9	763	64	9	59	9	838	60	9
73	9	765	74	9	60	9	841	61	9
63	11	769	64	11	67	9	846	67	9
74	9	771	75	9	70	5	852	69	5
73	9	775	74	9	67	9	853	70	9
77	5	777	78	5	70	9	854	72	9
69	8	780	70	8	68	9	857	69	9
77	5	781	77	5	55	6	862	54	6
66	5	784	67	4	64	9	863	65	9
70	5	785	70	4	62	6	868	62	6
75	9	788	76	9	70	9	869	71	9

Recorded by R. Plett Direction EB Lane 1 Time from 10:25 to 11:25

Sheet 20	* STATE_CODE	08
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 1 of* 2	* DATE	04/30/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
70	9	30229	70	9	72	9	30322	72	9
64	9	231	65	9	70	10	325	70	10
73	9	235	73	9	65	9	327	65	9
64	9	237	64	9	64	11	328	64	11
67	9	247	68	9	62	9	330	63	9
75	9	249	75	9	72	9	331	70	9
75	9	258	76	9	68	9	333	68	9
64	9	261	65	9	72	5	335	71	5
68	9	262	69	9	67	9	336	70	9
76	9	263	76	9	73	9	337	68	9
70	9	269	70	9	70	9	339	70	9
64	8	272	65	5	65	9	340	65	9
80	9	273	81	9	68	9	341	67	9
73	9	278	74	9	67	9	347	67	9
64	9	281	65	9	76	9	354	76	9
65	5	282	80	5	64	9	357	63	9
65	9	285	66	9	65	5	366	66	5
68	9	292	69	9	67	9	370	68	9
64	9	293	64	9	54	8	371	55	5
67	5	294	67	5	69	5	373	70	5
70	9	295	71	9	59	8	389	61	5
65	9	296	71	9	70	9	395	71	9
76	15	306	72	7	74	9	397	75	9
70	10	315	70	10	77	6	398	74	6
75	9	317	74	9	72	5	402	71	5

Recorded by RP Direction EB Lane 1 Time from 09:35 to 10:20

Sheet 20	* STATE CODE 08
LTPP Traffic Data	*SPS PROJECT ID 0200
Speed and Classification Checks * 2 of* 2	* DATE 09/30/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
66	6	30405	64	6	76	5	484	76	5
83	9	409	82	9	64	11	488	64	11
68	9	411	68	9	78	9	492	78	9
72	9	412	73	9	75	9	494	75	9
78	9	414	78	9	77	9	495	78	9
65	9	417	65	9	70	9	499	70	9
74	9	422	74	9	63	9	504	67	9
64	9	423	67	9	70	9	511	71	9
69	9	430	69	9	62	9	516	63	9
74	9	431	74	9	73	9	523	73	9
63	9	436	63	9	77	9	524	79	9
75	9	440	78	9	72	12	526	71	12
54	5	441	52	5	72	5	527	71	5
70	5	444	69	5	64	5	530	64	5
68	9	459	70	9	77	9	535	78	9
72	6	461	72	6	70	9	554	70	9
77	9	462	79	9	73	9	569	73	9
57	5	463	57	5	67	9	570	67	9
72	9	467	74	9	72	9	573	73	9
70	9	469	70	9	70	9	574	70	9
73	9	472	75	9	70	9	575	71	9
66	5	474	66	5	68	9	578	68	9
59	15	477	60	9	68	9	580	69	9
64	15	478	65	5	77	15	585	72	9
77	5	482	76	5	67	15	587	63	9

class 15 s not noted

67 RP

Recorded by R.PLETT Direction EB Lane 1 Time from 10:10 to 11:00

Sheet 21	* STATE_CODE	08
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 3	* DATE	04/29/2008

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
58.0	67	1	2	9:00	26212	67	5.9/5.5	8.2/8.3	8.5/7.5	9.0/8.5	8.8/9.4		78.6	17.8	4.9	27.0	3.9	
	68	2	2	9:00	26213	65	5.3/4.7	7.7/6.5	7.5/6.4	7.7/6.2	6.9/7.2		66.1	17.8	4.4	29.7	3.9	
58.5	74	1	3	9:28	26430	75	5.8/5.8	8.3/8.3	8.9/7.7	9.0/8.4	8.7/8.2		79.1	17.8	4.3	27.1	3.9	
	74	2	3	9:28	431	72	5.2/5.2	7.5/6.9	8.0/6.5	7.6/6.3	8.6/7.3		67.1	17.8	4.3	29.8	3.9	
66.0	64	1	4	9:53	537	64	6.1/5.5	8.2/8.3	8.3/7.3	9.0/8.4	9.0/8.5		78.6	17.8	4.3	27.1	3.9	
	64	2	4	9:53	538	63	5.6/4.7	7.9/6.6	7.2/6.5	7.5/6.4	6.9/7.1		65.3	17.8	4.3	29.7	4.0	
69.5	68	1	5	10:18	643	68	5.7/5.7	8.0/8.1	9.3/7.5	8.8/8.4	8.7/8.2		78.4	17.8	4.3	27.1	3.9	
	67	2	5	10:18	644	68	5.3/4.9	8.0/6.7	7.5/6.3	8.0/6.5	7.3/7.0		67.6	17.8	4.4	29.6	3.9	
72.5	74	1	6	10:43	744	74	5.7/5.7	8.4/8.4	9.3/7.3	9.0/8.7	9.3/8.0		79.8	17.8	4.3	27.1	3.9	
	72	2	6	10:43	745	72	5.3/5.0	7.7/6.6	8.4/6.2	7.5/6.7	6.4/6.7		66.4	17.8	4.3	29.8	3.9	
75.0	61	1	7	11:08	818	63	6.1/5.2	8.4/7.4	8.8/6.7	8.9/8.1	8.8/8.1		76.7	17.8	4.3	27.2	3.9	
	62	2	7	11:08	819	62	5.3/4.6	7.5/6.7	6.8/6.7	7.9/6.0	6.8/6.6		69.5	17.8	4.3	29.7	3.9	
82.5	67	1	8	11:36	924	67	5.9/5.5	8.2/8.4	8.6/7.3	9.0/8.5	8.7/8.0		78.0	17.8	4.4	27.1	3.9	
	68	2	8	11:36	925	67	5.2/4.8	7.7/6.2	7.6/6.5	7.3/6.5	7.1/7.3		66.0	17.8	4.4	29.7	3.9	
86.5	74	1	9	12:00	27021	74	5.9/5.5	8.4/8.5	9.3/7.5	9.0/8.7	9.2/8.4		80.4	17.8	4.3	27.1	3.9	
	73	2	9	12:00	27022	73	5.1/4.7	7.9/6.5	8.8/6.1	7.8/6.4	7.6/7.6		68.5	17.7	4.3	29.9	3.9	

Recorded by R. RIGGS

Checked by

Sheet 21	* STATE_CODE	08
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of 3	* DATE	04/29/2008

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
86.5	63	1	10	12:25	27116	64	5.9/5.4	8.1/7.6	8.1/7.3	8.8/8.3	8.7/8.1		76.3	17.8	4.3	27.1	3.9	
	61	2	10	12:25	27117	62	5.5/4.7	7.5/6.8	7.2/6.7	7.5/6.1	7.0/6.6		65.7	17.8	4.3	29.7	3.9	
88.0	68	1	10	12:50	215	68	5.6/5.8	8.0/8.3	8.7/7.3	8.9/8.6	8.5/8.7		78.5	17.7	4.3	27.0	3.9	
	68	2	10	12:50	216	68	5.3/4.7	7.7/6.3	7.2/5.9	7.9/6.2	6.9/6.8		64.9	17.8	4.3	29.8	3.9	
80.5	70	1	12	13:34	27370	70	5.8/5.6	8.3/8.4	9.3/7.7	9.2/8.6	9.0/8.4		80.2	17.8	4.3	27.2	3.9	
	73	2	12	13:34	370	72	5.9/5.1	7.8/6.6	8.0/6.1	7.6/6.5	7.6/7.1		67.7	17.8	4.3	24.7	4.0	
75.0	62	1	13	13:59	478	64	5.9/5.4	8.2/8.0	8.5/7.1	8.9/8.4	8.9/8.9		77.8	17.8	4.4	27.0	3.9	
	64	2	13	13:59	479	64	5.3/4.6	7.6/6.7	7.3/6.8	7.7/6.3	6.7/7.1		66.1	17.8	4.3	24.6	3.9	
88.0	67	1	14	14:25	592	65	6.0/5.4	8.0/8.3	8.7/7.2	8.8/8.5	8.5/8.4		77.8	17.8	4.4	27.0	3.9	
	65	2	14	14:25	593	67	5.9/4.8	7.8/6.4	7.8/6.4	7.9/6.5	6.9/7.1		67.0	17.7	4.3	29.7	3.9	
91.0	71	1	15	14:50	703	72	5.9/5.3	8.3/7.9	9.3/7.1	9.4/8.3	9.2/8.1		79.0	17.8	4.3	27.2	3.9	
	74	2	15	14:50	704	75	5.5/4.8	7.6/6.7	8.0/6.4	8.5/6.2	7.3/7.3		68.3	17.7	4.3	29.7	4.0	
89.5	63	1	16	15:15	792	64	6.0/5.4	7.9/7.7	9.0/7.0	8.8/8.2	8.8/8.2		76.9	17.8	4.3	27.1	3.9	
	63	2	16	15:15	793	64	5.6/4.7	7.9/6.8	7.0/6.9	7.4/6.3	6.9/6.7		65.7	17.8	4.3	29.7	3.9	
84.5	67	1	17	15:40	887	67	5.8/5.5	8.1/8.1	8.5/7.2	9.0/8.5	9.0/8.9		78.9	17.7	4.3	27.0	3.9	
	64	2	17	15:40	888	64	5.5/4.8	7.5/6.3	7.0/6.8	7.8/6.4	6.3/7.2		65.7	17.8	4.3	29.7	3.9	

Recorded by R. BLETT

Checked by

Sheet 21	* STATE_CODE	0 8
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 2 of 3	* DATE	0 4 / 2 9 / 2 0 0 8

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
93.0	72	1	18	15:54	27991	72	5.7/5.3	8.3/8.1	9.4/7.1	9.2/8.7	9.0/8.4		79.3	17.8	4.3	27.2	3.9	
	74	2	18	15:54	992	72	5.4/5.0	7.5/6.7	8.4/6.1	7.9/6.4	7.7/7.6		68.6	17.8	9.3	24.8	3.9	
90.0	62	1	19	16:03	976	62	6.1/5.3	8.2/7.8	8.7/7.9	9.1/8.1	8.9/7.8		77.5	17.8	4.3	27.1	3.9	
	70	2	19	16:03	979	70	5.2/5.1	7.6/6.9	7.7/6.7	7.7/6.9	6.8/7.4		67.1	17.8	4.3	24.8	3.9	
90.0	68	1	20	16:11	28011	68	5.8/5.4	8.0/7.9	9.1/6.8	8.8/8.5	8.6/8.9		77.3	17.8	4.4	27.2	3.9	
	64	2	20	16:11	012	62	5.4/4.5	7.7/6.9	7.4/6.5	7.8/6.2	6.8/6.6		65.5	17.8	4.3	24.7	3.9	
58.0	63	1	1	8:35	26183	63	6.1/5.5	8.7/7.7	8.6/7.4	9.0/8.5	8.7/8.3		78.1	17.8	4.3	27	3.9	
	63	2	1	8:35	26184	63	5.5/4.7	7.6/6.7	7.1/6.8	7.8/6.1	6.7/6.9		65.8	17.8	4.4	24.7	3.9	
From data download																		

Recorded by R. PLETT

Checked by

Sheet 21	* STATE_CODE	08
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 1	* DATE	04 / 30 / 2008

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
47.5	73	1	1	7:47	29767	74	5.5/5.6	7.9/7.8	8.2/7.2	8.5/8.2	8.4/7.7		75.0	17.8	4.3	27.2	3.9	
	73	2	1	7:47	768	72	5.0/5.1	7.2/6.8	7.6/6.3	7.1/6.1	6.7/7.2		65.0	17.8	4.3	24.8	3.9	
54	64	1	2	8:06	839	64	5.9/5.3	8.0/7.8	8.4/7.2	8.8/8.3	8.7/8.1		76.5	17.8	4.3	27.1	3.9	
	62	2	2	8:06	840	63	5.6/4.7	7.9/6.7	7.2/6.6	7.5/6.2	6.7/7.1		65.7	17.8	4.3	24.7	3.9	
59.5	68	1	3	8:33	956	68	5.7/5.4	7.8/8.0	8.0/7.2	8.5/8.7	8.4/8.4		76.1	17.8	4.4	27.0	3.9	
	68	2	3	8:33	957	68	5.1/5.0	7.4/6.4	7.7/6.1	7.3/6.4	6.2/6.8		64.5	17.8	4.4	24.8	3.9	
69.5	74	1	4	8:52	30044	75	5.7/5.3	8.0/7.7	8.4/7.2	8.5/8.2	8.4/7.4		79.9	17.8	4.3	27.1	3.9	
	71	2	4	8:52	045	72	5.0/4.8	7.3/6.4	7.3/6.1	6.9/6.3	5.7/6.4		62.2	17.8	4.3	24.7	4.0	
65.5	66	1	5	9:09	121	65	6.0/5.5	7.8/7.3	8.7/7.2	8.7/8.1	8.3/7.9		75.5	17.8	4.3	27.1	3.9	
	65	2	5	9:09	123	64	5.3/4.9	7.4/6.8	6.9/6.9	7.2/6.4	6.5/7.4		65.6	17.8	4.3	24.6	3.9	
71	70	1	6	9:27	182	69	5.6/5.4	7.9/8.0	8.3/7.3	8.5/8.5	8.4/8.0		75.8	17.8	4.4	27.1	3.9	
	70	2	6	9:27	184	69	5.1/4.8	7.3/6.4	7.8/6.0	7.1/6.5	6.7/6.6		64.4	17.8	4.4	24.1	3.9	

Recorded by RR

Checked by DM

64200 T0022 SPSWIM_TO_24_08_2102_ Sheet_21.doc

0200 - CA - 1

Sheet 21	* STATE_CODE	0 8
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 1 of 2	* DATE	0 4 / 3 0 / 2 0 0 8

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
76.0	74	1	7	9:53	30297	74	5.5/5.6	7.9/8.2	8.8/7.3	8.6/8.2	8.7/7.7		76.5	17.8	4.3	27.2	3.9	
	74	2	7	9:53	298	75	4.9/4.9	7.0/6.7	7.5/6.1	7.1/6.4	6.0/6.7		63.1	17.7	4.3	29.7	4.0	
77.5	64	1	8	10:10	376	65	5.8/5.3	7.9/7.5	8.4/7.1	8.8/8.2	8.7/8.4		76.5	17.8	4.3	27.1	3.9	
	66	2	8	10:10	378	66	5.1/4.9	7.4/6.6	7.1/6.5	7.3/6.6	6.3/6.4		64.2	17.7	4.4	24.6	3.9	
82.0	66	1	9	10:27	495	68	5.7/5.3	8.2/8.2	8.4/7.1	8.8/8.2	8.8/7.8		76.4	17.8	4.9	27.1	3.9	
	67	2	9	10:27	496	70	4.8/4.6	7.1/6.4	8.2/6.1	7.1/6.5	6.2/7.3		69.8	17.7	4.3	29.8	3.9	
88.5	73	1	10	10:52	556	73	5.5/5.5	7.9/8.4	8.9/7.1	8.7/8.3	8.6/7.8		76.7	17.8	4.3	27.2	3.9	
	73	2	10	10:52	30557	71	4.9/4.9	7.3/6.3	7.8/6.0	7.2/6.5	6.9/7.5		65.3	17.8	4.3	29.8	3.9	
93.5	67	1	11	12:07	43	67	5.6/5.3	7.7/7.1	8.9/6.7	8.5/7.9	8.4/7.5		79.1	17.8	4.3	27.2	3.9	
	68	2	11	12:07	44	68	5.1/4.5	7.2/6.3	7.3/6.0	7.1/5.9	6.9/6.5		62.9	17.8	4.3	29.8	3.9	
93.5	73	1	12	12:23	101	73	5.4/5.3	8.0/7.4	8.9/6.8	8.4/8.1	8.5/7.9		79.8	17.7	4.3	27.1	3.9	
	72	2	12	12:23	102	73	4.9/4.8	6.9/6.3	7.7/5.9	7.2/6.1	5.8/6.6		62.2	17.7	4.3	29.7	3.9	
98.5	64	1	13	12:30	125	64	5.4/5.5	7.6/7.7	8.4/7.2	8.5/8.2	8.9/7.9		74.7	17.7	4.3	27.1	3.9	
~~95.5~~	69	2	13	12:30	126	64	4.6/4.8	7.1/6.6	7.1/6.7	7.1/6.1	6.3/7.1		63.5	17.7	4.3	24.6	3.9	
95.5	68	1	14	12:38	161	68	5.7/5.3	8.0/7.9	8.7/6.7	8.9/7.9	8.6/7.7		75.1	17.8	4.3	27.2	3.9	
	70	2	14	12:38	162	70	4.8/4.4	7.5/6.3	7.9/6.1	7.3/6.1	6.2/7.2		63.6	17.8	4.3	24.8	3.9	

Recorded by R PLETT

Checked by

Sheet 21	* STATE_CODE	0 8
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 2 of 2	* DATE	04/30/2008

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
101.0	73	1	15	13:03	254	73	5.5/5.2	7.8/7.7	8.0/7.0	8.9/8.0	8.3/8.0		73.8	17.8	4.3	27.0	3.9	
	73	2	15	13:03	255	73	4.9/4.8	7.3/6.0	7.3/5.9	7.2/6.3	6.5/7.0		63.1	17.7	4.3	24.6	3.9	
99.5	64	1	16	13:14	295	65	5.5/5.4	7.6/7.5	8.2/7.0	8.7/8.0	8.9/7.8		79.5	17.8	4.3	27.1	3.9	
	67	2	16	13:15	296	70	4.9/4.7	7.1/6.3	7.6/6.0	7.3/6.1	6.5/6.2		62.7	17.7	4.3	24.7	3.9	
101.5	68	1	17	13:21	315	68	5.2/5.3	7.9/7.3	8.2/6.6	8.5/8.0	8.6/7.6		74.4	17.8	4.3	27.2	3.9	
	70	2	17	13:21	317	70	4.8/4.6	7.2/6.4	7.8/5.8	7.3/6.1	6.2/6.2		62.3	17.8	4.3	24.7	3.9	
102.5	73	1	18	13:45	409	73	5.5/5.2	7.7/7.6	8.1/6.9	8.7/8.0	8.4/8.0		74.1	17.8	4.3	27.1	3.9	
	72	2	18	13:45	410	72	4.8/4.8	7.1/6.4	7.3/6.1	7.2/5.9	6.5/6.4		62.5	17.7	4.3	24.7	4.0	
101.0	64	1	19	14:02	473	65	5.3/5.3	7.6/7.3	8.6/6.8	8.6/8.1	8.6/8.0		79.7	17.8	4.3	27.2	3.9	
	65	2	19	14:02	474	68	4.7/4.5	7.6/6.0	7.6/6.0	7.9/5.9	6.7/6.9		63.3	17.8	4.3	24.7	3.9	
101.0	67	1	20	14:08	507	67	5.3/5.1	7.6/7.6	8.8/6.6	8.4/8.0	8.5/7.7		73.8	17.8	4.3	27.1	3.9	
	68	2	20	14:09	508	68	4.7/4.4	7.4/6.2	7.6/5.9	7.1/6.0	5.9/6.4		61.6	17.7	4.3	24.7	3.9	

Recorded by RPH

Checked by DJV

Calibration Worksheet

Site: 080200

Calibration Iteration 1 Date 4/29/08

Beginning factors:

Speed Point (mph)	Name	Left Sensor 1 / 3	Right Sensor 2 / 4
Overall			
Front Axle			
Distance	distance	~~350~~ 370	
1 – (55) 55	55 mph 88 kph	~~3577~~ 3502	3466
2 – (60) 60	96 kph	~~3558~~ 3517	3482
3 – (65) 65	104 kph	3558	3524
4 – (70) 70	112 kph	3606	3570
5 – (75) 75	120 kph	3601	3526

Errors:

	Speed Point 1 (65)	Speed Point 2 (70)	Speed Point 3 (75)	Speed Point 4 ( )	Speed Point 5 ( )
F/A					
Tandem					
GVW					

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☐	☐	
Speed Point 1	☐	☐	
Speed Point 2	☐	☐	
Speed Point 3	☐	☑	-2.2
Speed Point 4	☐	☑	-3.5
Speed Point 5	☐	☑	-5.1

End factors:

Speed Point (mph)	Name	Left Sensor 1 / 3	Right Sensor 2 / 4
Overall			
Front Axle			
Distance	distance	370	
1 – (55)	88 kph	3502	3466
2 – (60)	96 kph	3517	3482
3 – (65)	104 kph	3480	~~3522~~ 3447
4 – (70)	112 kph	3480	~~3395~~ 3446
5 – (75)	120 kph	3419	~~3267~~ 3386

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

April 29, 2008

STATE: Colorado

SHRP ID: 080200

Photo 1 08_0200_Truck_1_Tractor_04_29_08.jpg

Photo 2 08_0200_Truck_1_Trailer_04_29_08.jpg

Photo 3 08_0200_Truck_1_Suspension_1_04_29_08.jpg

Photo 4 08_0200_Truck_1_Suspension_2_04_29_08.jpg

Photo 5 08_0200_Truck_1_Suspension_3_04_29_08.jpg

Photo 6 08_0200_Truck_2_Tractor_04_29_08.jpg

Photo 7 08_0200_Truck_2_Trailer_04_29_08.jpg

Photo 8 08_0200_Truck_2_Suspension_1_04_29_08.jpg

Photo 9 08_0200_Truck_2_Suspension_2_04_29_08.jpg

Photo 10 08_0200_Truck_2_Suspension_3_04_29_08.jpg

ETG LTPP CLASS SCHEME, MOD 3

Class	Vehicle Type	No. Axles	Spacing 1	Spacing 2	Spacing 3	Spacing 4	Spacing 5	Spacing 6	Spacing 7	Spacing 8	Gross Weight Min-Max	Axle 1 Weight Min *
1	Motorcycle	2	1.00-5.99								0.10-3.00	
2	Passenger Car	2	6.00-10.10								1.00-7.99	
3	Other (Pickup/Van)	2	10.11-23.09								1.00-7.99	
4	Bus	2	23.10-40.00								12.00 >	
5	2D Single Unit	2	6.00-23.09								8.00 >	2.5
2	Car w/ 1 Axle Trailer	3	6.00-10.10	6.00-25.00							1.00-11.99	
3	Other w/ 1 Axle Trailer	3	10.11-23.09	6.00-25.00							1.00-11.99	
4	Bus	3	23.10-40.00	3.00-7.00							20.00 >	
5	2D w/ 1 Axle Trailer	3	6.00-23.09	6.30-30.00							12.00-19.99	2.5
6	3 Axle Single Unit	3	6.00-23.09	2.50-6.29							12.00 >	3.5
8	Semi, 2S1	3	6.00-23.09	11.00-45.00							20.00 >	3.5
2	Car w/ 2 Axle Trailer	4	6.00-10.10	6.00-30.00	1.00-11.99						1.00-11.99	
3	Other w/ 2 Axle Trailer	4	10.11-23.09	6.00-30.00	1.00-11.99						1.00-11.99	
5	2D w/ 2 Axle Trailer	4	6.00-26.00	6.30-40.00	1.00-20.00						12.00-19.99	2.5
7	4 Axle Single Unit	4	6.00-23.09	2.50-6.29	2.50-12.99						12.00 >	3.5
8	Semi, 3S1	4	6.00-26.00	2.50-6.29	13.00-50.00						20.00 >	5.0
8	Semi, 2S2	4	6.00-26.00	8.00-45.00	2.50-20.00						20.00 >	3.5
3	Other w/ 3 Axle Trailer	5	10.11-23.09	6.00-25.00	1.00-11.99	1.00-11.99					1.00-11.99	
5	2D w/ 3 Axle Trailer	5	6.00-23.09	6.30-35.00	1.00-25.00	1.00-11.99					12.00-19.99	2.5
7	5 Axle Single Unit	5	6.00-23.09	2.50-6.29	2.50-6.29	2.50-6.30					12.00 >	3.5
9	Semi, 3S2	5	6.00-30.00	2.50-6.29	6.30-65.00	2.50-11.99					20.00 >	5.0
9	Truck+FullTrailer (3-2)	5	6.00-30.00	2.50-6.29	6.30-50.00	12.00-27.00					20.00>	3.5
9	Semi, 2S3	5	6.00-30.00	16.00-45.00	2.50-6.30	2.50-6.30					20.00 >	3.5
11	Semi+FullTrailer, 2S12	5	6.00-30.00	11.00-26.00	6.00-20.00	11.00-26.00					20.00 >	3.5
10	Semi, 3S3	6	6.00-26.00	2.50-6.30	6.10-50.00	2.50-11.99	2.50-10.99				20.00 >	5.0
12	Semi+Full Trailer, 3S12	6	6.00-26.00	2.50-6.30	11.00-26.00	6.00-24.00	11.00-26.00				20.00 >	5.0
13	7 Axle Multi's	7	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00			20.00 >	5.0
13	8 Axle Multi's	8	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00		20.00 >	5.0
13	9 Axle Multi's	9	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	20.00 >	5.0

Spacings in feet
Weights in kips (Lbs/1000)
* Suggested Axle 1 minimum weight threshold if allowed by WIM system's class algorithm programming

System Operating Parameters

Colorado SPS-2 (Lane 1)

Left Sensor

Validation Visit	**April 30, 2008**	**April 29, 2008**	**October 17, 2007**
Factor			
Distance	370	370	
Bin 1 88 kph (55 mph)	3502	3502	3698
Bin 2 96 kph (60 mph)	3517	3517	3715
Bin 3 105 kph (65 mph)	3480	3558	3759
Bin 4 112 kph (70mph)	3480	3606	3808
Bin 5 120 kph (75 mph)	3419	3601	3804

Right Sensor

Validation Visit	**April 30, 2008**	**April 29, 2008**	**October 17, 2007**
Factor			
Distance			
Bin 1 88 kph (55 mph)	3466	3466	3698
Bin 2 96 kph (60 mph)	3482	3482	3715
Bin 3 105 kph (65 mph)	3447	3524	3759
Bin 4 112 kph (70mph)	3446	3570	3808
Bin 5 120 kph (75 mph)	3386	3566	3804